# SCIENTIFIC AMERICAN

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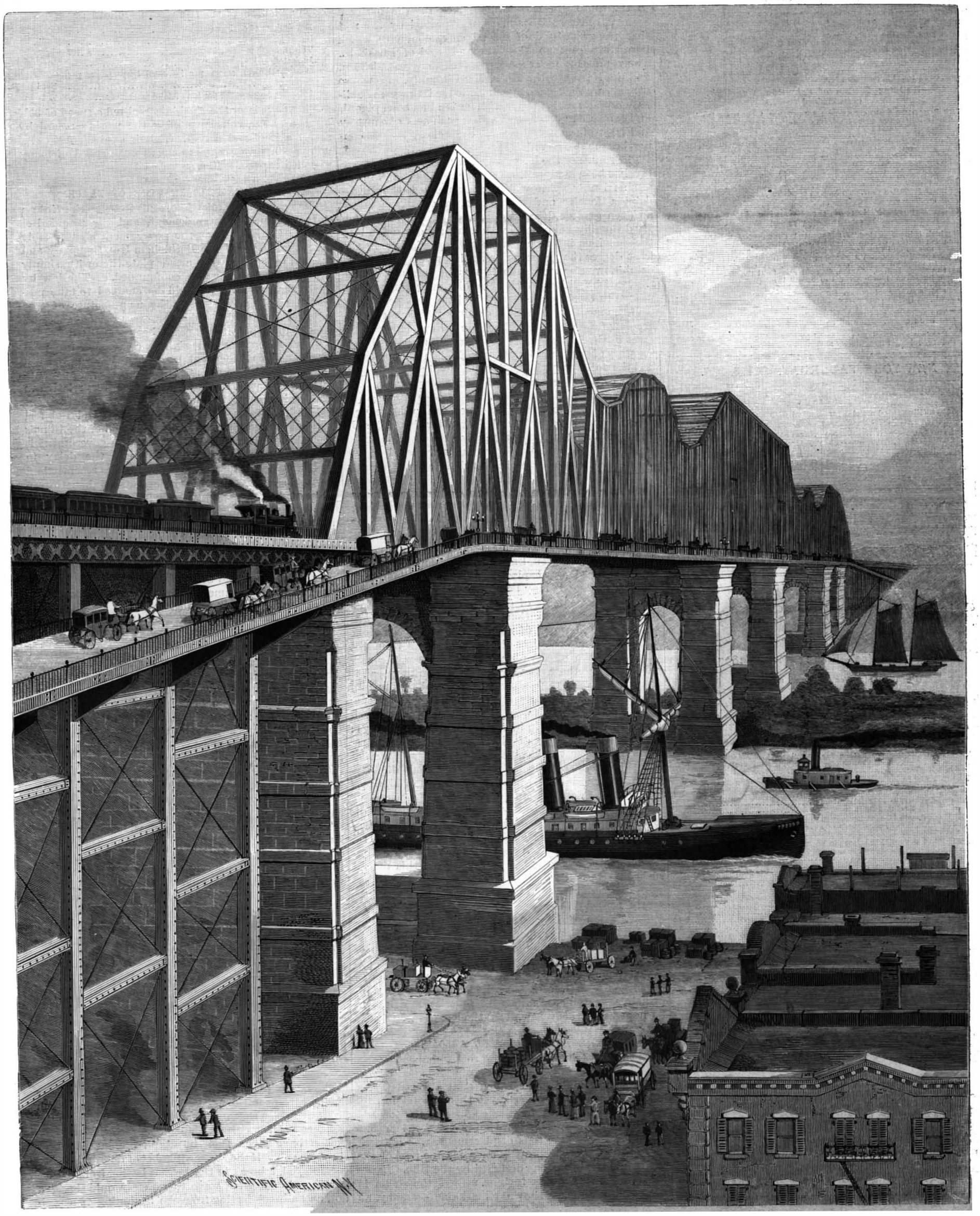


**THE NEW YORK AND LONG ISLAND BRIDGE AT BLACKWELL'S ISLAND, NEW YORK CITY.**—[See page 294.]

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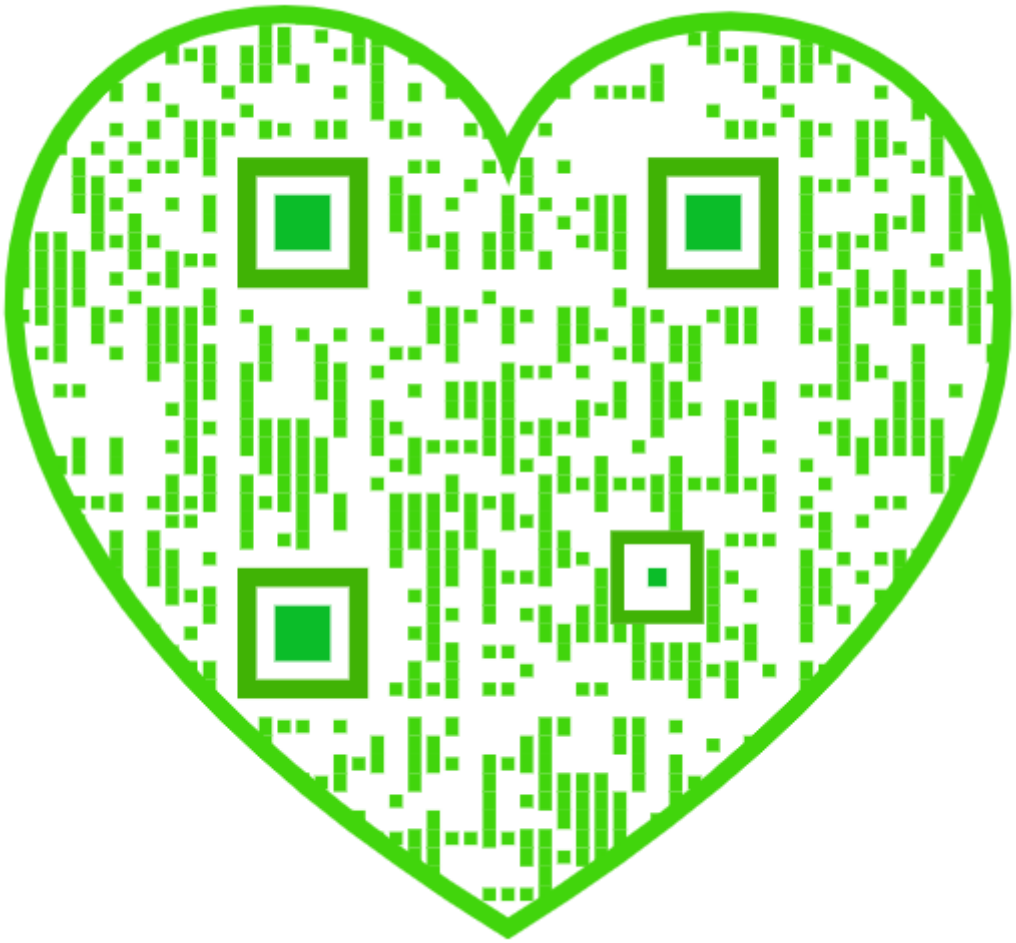

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### A GRACEFUL ACT OF INTERNATIONAL COURTESY.

We mentioned in our previous issue that the manuscript log of the Mayflower had been delivered to the United States through its representative, Ambassador Bayard, on an order given in the Consistory Court of London. In this issue we present our readers with a photographic reproduction of this priceless relic, which, in point of its unrivaled historic interest, may be said to stand quite alone.

The manuscript volume of the log, at the time of the petition for its removal to the United States, formed part of the library of Fulham Palace, the residence of the Bishop of London, and among the precedents which were quoted on behalf of the petition was the case of the Library Company of Philadelphia. This company discovered that certain manuscript volumes presented to the library in 1799 formed part of the national archives of Great Britain, as was proved by the fact that they consisted of official correspondence which bore the sign manual of James I and of Elizabeth. The volumes were at once restored to Great Britain, and the Master of the Rolls, Lord Romilly, into whose official care they passed, acknowledged the great obligation under which the British nation had been placed, and expressed his conviction that such acts of courtesy and friendliness would tend to draw closer the ties connecting the two countries.

The return of the log of the Mayflower to this country has been made with the same readiness and in the same friendly spirit which characterized the Philadelphia transfer, and, if anything, we are placed under an even greater debt of obligation than that which Lard Romilly acknowledged on behalf of England in the previous instance. Without depreciating in the least degree the generous spirit in which the Philadelphia transfer was made, it may be pointed out that the British archives which were voluntarily surrendered related to England alone, and had no historical interest to connect them with this country. The records of the Mayflower, on the other hand, have naturally a great intrinsic interest for the English people, as being the story of the struggles of early English colonists who had the full sympathy of the middle English classes, from which they came and of whose sterling qualities they were faithful exponents.

The fact that there was no opposition to the request of Ambassador Bayard, and that, after this valuable document had been over a century in their undisputed possession, it should be so freely surrendered at our first request, is another striking evidence of the friendly feeling unselfishly entertained by the English people toward this country.

### FREE DISTRIBUTION OF SEEDS BY THE GOVERNMENT.

There is a growing agitation against what is known as the free distribution of seed by the government. The system is too well known to the majority of our readers to need any explanation; but for the benefit of city residents it may be said that the government has been in the habit of doling out annually to Congressmen for distribution among their constituents about $140,000 worth of seeds. This has been done with the expressed object of securing reports from the users as to the results obtained. Whatever theoretical advantage there may have been in the proposal, it has failed utterly to produce any practical results, and according to all reports the experiment has degenerated into a positive farce. The United States Agricultural Department in its report on this subject says: "While one purpose of the law was to secure reports from the receivers as to the results of actual experiment, the reports actually received did not amount to one-hundredth of one per cent of the persons supplied. A careful review of the department reports, especially those of the chiefs of the seed division during the past decade, in which over $1,000,000 was expended for free seed distribution, fails to reveal a single instance of benefit to agriculture attributable to this distribution." In the face of this official statement, one asks with no small amount of bewilderment, why did the last agricultural bill, which recently passed both houses of Congress, contain an appropriation of $150,000 for carrying on this palpable folly? If Congressmen can see any sound ethical or political reasons for a paternal distribution of seeds, why should they stop just here? Why not appropriate another $150,000 for spades, plows and fertilizers? As a matter of fact, the system is wrong in principle as well as a failure in practice, and it is to be hoped that this year will see the last of it.

### THE FASTEST VESSEL AFLOAT.

It is a great triumph for the "rotary impact" form of steam engine that the first one of this type fitted to a steamship should have driven it at a speed far in excess of the world's record, yet this is what has recently been achieved by the engines of the torpedo boat Turbinia. This little vessel of 100 feet length, 9 feet beam, and 44½ tons displacement, was built at Newcastle, England, specially for a marine trial of the compound steam turbine designed by the Hon. Charles Parsons. The Parsons turbine utilizes the steam in three stages and has shown remarkable economy, an engine of this type which is at work in the electric works, Cambridge, England, having achieved a consumption of 15·1 pounds of steam per indicated horse power per hour. The Turbinia was at first fitted with a single engine and screw, and in the trials the "cavitation," or vacuum formed behind the propeller, was such that very disappointing results followed. The single turbine was removed and replaced by three separate turbines directly coupled to three screw shafts, the turbines being respectively the high pressure, intermediate and low pressure elements of a triple expansion engine. The results were truly remarkable, a speed of 29·6 knots being realized. After further experiment to determine the proper pitch for the screws, a series of trial runs were made on April 1 of this year, when a mean speed of 31·01 knots an hour was realized. The particulars of the run were as follows:

| | |
|---|---|
| Revolutions of engines (mean) | 2,100 |
| Steam pressure | 200 lb. |
| Thrust, horse power (calculated) | 946 |
| Indicated " " | 1,576 |
| Consumption of steam per indicated horse power per hour | 15 86 |
| Indicated horse power per ton of total machinery | 72·1 |

Nine days later the Turbinia realized a speed of 32¾ knots an hour, thus surpassing the world's record by about a knot and a half. This is equivalent to 37¾ miles an hour, or equal to the average speed of many so-called express trains.

### WAR MEASURES IN TIME OF PEACE.

The naval armor question seems to be getting into a state of hopeless entanglement, and the proposal of Senator Chandler that the government shall forcibly seize the plant of the Bethlehem Iron Company and proceed to make its own armor plate therewith simply makes "confusion worse confounded." The law by which the government would be enabled to take possession of these works for the manufacture of war material is intended to cover cases of emergency in time of war; but it has never been construed to give the government the same right in a period of profound peace such as the present. It is reassuring to learn that the bill is likely to receive very little, if any, support. Secretary Long's letter to Congress relative to the bids in answer to the department's advertisement of March 10 states that the department did not feel justified in accepting or rejecting the bid of the Illinois Steel Company, and points out that the government is liable to incur heavy expense due to the delay in furnishing armor for the three battleships recently laid down, if some steps are not immediately taken to procure the needed supply. The secretary closes by recommending that authority be given the department to make contracts at a price not exceeding $400 per ton, "the rate recommended by my predecessor." This figure was arrived at as being a just price after the question had been carefully investigated by a board of experts, and under the circumstances it looks as though the recommendation of Secretary Long was the easiest way out of the deadlock.

### HIGH SPEED TELEGRAPHY.

By making use of the alternating current and special designs of receiver and transmitter, two well-known American specialists have succeeded in sending messages over a wire at the rate of twelve hundred words a minute, and they confidently assert that between three thousand and six thousand words a minute may be dispatched by the same system between points that are a thousand miles apart. The new telegraphy marks a wonderful advance over existing methods. An operator using the Morse key sends only forty words a minute, and by the Wheatstone system about one hundred and fifty words can be sent over a single wire in the same time.

This epoch-marking invention, which, if it fulfills its early promise, will rank as one of the greatest of the century, is the result of the joint labors of Lieutenant G. O. Squier and Prof. A. C. Crehore, and it was first announced in a paper which was read at the New York meeting of the American Institute of Electrical Engineers on April 20. The paper, with complete illustrations, is published in the current issue of the SUPPLEMENT, and it will be found to be one of the most valuable contributions ever made to the literature upon this subject.

The new scheme, as we have said, uses an alternating in place of a constant current. In the latter, a break in the contact of two wire terminals causes the emission of a spark; but if an alternating current be broken at the zero line, that is just where the alternation takes place between a positive and negative wave, there will be no spark. The Squier and Crehore device takes advantage of this feature and interrupts and restores the current at the zero points of oscillation. The operator adjusts his instrument until the sparking disappears, at which point he knows that its action is synchronous with the frequency of the current employed. Hence these gentlemen have given their telegraph the name of synchronograph. If the Morse alphabet of dots and dashes is employed, a break in the current lasting from the beginning of a positive wave to its end would signify a dot, and a break lasting from the beginning of a posi-

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tive wave to the end of the following negative wave would signify a dash. The interruption must last just half a cycle or a whole cycle, a positive and a negative wave together constituting a cycle. The intervals between dots and dashes must also, of course, be either half cycles or multiples of a half cycle.

The transmitter in the experiments consisted of a narrow wheel with a flat metallic periphery, which was rotated at a high rate of speed, which was such that it was an exact multiple of the length of one cycle. The current was transmitted to the wheel by two metallic brushes, which were arranged side by side in contact with the periphery of the wheel. It is evident that the current would ordinarily flow from one brush through the wheel to the other brush; but if a strip of insulating material were pasted on the wheel in the line of one brush, every time it came round and passed under that brush the current would be broken. A strip of paper was perforated with holes of various length corresponding to the Continental Code, which was used in the experiments, and it was carried over the wheel in much the same way as a belt is by a pulley. Just as long as the brushes were separated by the paper the current was intercepted, and whenever the brush reached a hole and touched the wheel the current was restored. The breaks and contacts were arranged so as to occur exactly at the zero point of the alternations, as explained above, so that no sparking occurred.

The receiver was the polarizing photo-chronograph which Messrs. Squier and Crehore designed for use in timing the flights of projectiles. This ingenious instrument was fully described in a paper contributed to the SCIENTIFIC AMERICAN SUPPLEMENT by these gentlemen and published in the issue of January 2, to which our readers are referred for the full details and illustrations. The current in this instrument passes through a coil of wire which surrounds an instrument called an "analyzer." A ray of polarized light from an arc lamp passes through a series of lenses, and when no current is flowing the analyzer is in such a position as to shut out the ray. When the current passes through the coil the plane of polarization is rotated in such a way as to permit the light to pass again, and the very rapid flashes of light are recorded upon a photographic plate.

The paper of Messrs. Squier and Crehore closes with a suggestion as to the changes that will be effected by introducing a telegraph postal system. It is estimated, for instance, that it would require only two lines working on their system, if they were in continuous operation, to handle the entire postal business between New York and Chicago, which amounts to about 40,000 letters daily. By the present system it takes three days to receive a business reply between the cities named, but by the aid of machine telegraphy working at the rate of 3,000 words a minute, a letter could be sent and a reply received on the same day.

Our readers will recognize in this proposal some of the features of the Delany system, and the inventors of the "synchronograph" have given very generous credit to this ingenious system in the course of the paper under discussion.

## OUR SALTPETER CAVES IN TIME OF WAR.

BY HORACE C. HOVEY.

Saltpeter, literally rock salt, chemically potassium nitrate, also known as niter, is remarkable for storing oxygen in a solid form. One volume of it has three thousand times as much oxygen as a like volume of atmospheric air. At a certain degree of heat this immense quantity of oxygen combines violently with carbon, thus forming carbonic acid gas, and also setting free a quantity of nitrogen. Gunpowder contains about 75 parts of niter to 15 of charcoal and 10 of sulphur. If ignited in vacuo, the powder quietly resolves itself into gas. But in the chamber of a gun, behind a ball, it explodes with energy and hurls the missile with deadly effect. For this reason saltpeter is essential to any nation engaged in warfare.

Edward Rawson was the first to attempt the manufacture of gunpowder in the New England colonies. In 1639 the General Court of Massachusetts granted him five hundred acres at Pequod, "so he go on with the business of powder, if the saltpeter come." By act of June 14, 1642, all towns and families were ordered to promote the manufacture of saltpeter. But nothing was accomplished, and in 1648 the General Court voted to indemnify Rawson for his losses in the experiments made. I am indebted to Mr. R. N. Toppan for this authentic information, not found in local histories. Rawson was deputy from Newbury, and secretary of the colony.

At the opening of the revolutionary war the military stores of New England were mainly kept at Quarry Hill, near Medford, Mass, where they had two hundred and fifty barrels of powder, which was seized by the British on September 1, 1774. The act set the country aflame, and stirred the indignation of Burke, Pitt and Fox. After the news from Lexington and Concord, in 1775, the colonies were scoured for powder, and less than sixty-eight barrels were found. New York had but one hundred pounds. Lord Dunmore had seized the entire supply in Virginia, and when Patrick Henry demanded its restoration at the head of troops, he only got its money value and not the powder. When Washington took command of the troops raised by the colonies he "made the alarming discovery that there was not more powder than sufficient to furnish each man with nine cartridges. By great address this dangerous deficiency was concealed from the enemy." (Holmes' Annals, vol. ii, p. 240.)

It is remarkable that no American history, so far as I know, tells us whence the robbed and impoverished colonies got their powder wherewith to wage the war of the revolution. A similar gap exists concerning the war of 1812, when an embargo cut us off from foreign supplies. We are told about almost everything else, but not where we found our saltpeter. That question is now answered.

Among those who resisted the tyranny of Lord Dunmore in stealing the ammunition of Virginia were two young men named Thomas Jefferson and James Madison. They were not only patriots and statesmen, but were also cave hunters. Among the caves found by Jefferson was one that he named for his friend, "Madison's Cave," located in the Grottoes Ridge, in which also occur Weyer's Cave and the Cave of Fountains. Major Jed Hotchkiss, the veteran map maker and geologist, is my authority for saying that Madison's Cave was mined for saltpeter during the three great wars, of the revolution, of 1812, and of the rebellion—probably the only cave on the continent of which that can be said. But Jefferson found many other and richer saltpeter caves, which he describes in his "Notes on Virginia," page 44. He says that one of the largest was on Rich Creek, a branch of the Kanawha, from which more than eleven thousand pounds of niter were obtained. Others were on the Cumberland River, and at least fifty were in the Greenbrier Valley, in one of which Jefferson found the typical megalonyx made famous by Cuvier. His account is all the more valuable because written while the war of the revolution was going on, and thus showing us whence the patriots obtained their means to carry it forward. To a limited extent gunpowder was seized from the enemy, and a few pounds of saltpeter were made from excavations under old stables, and by artificial processes, but the bulk of it undoubtedly came from the caves of Virginia.

Kentucky was originally set off from Augusta County, Virginia, as Kentucky County, in 1776, and was made a State in 1792. Among its early settlers were strolling chemists who knew of the caves in the Greenbrier Valley and elsewhere, and hunted for similar ones in the newly organized State. They were richly rewarded. Under ledges, in "rock houses" and "rock castles," they found solid masses of niter weighing from 100 to 1,600 pounds. Previous to 1800 there had been found 28 saltpeter caves in Kentucky, from which more than 100,000 pounds of saltpeter had been obtained. These facts led Dr. Samuel Brown, of Lexington, Ky., to make a journey of 1,000 miles on horseback, in 1806, in order to lay them before the American Philosophical Society at Philadelphia. He closed his able paper, probably the first of its kind, with these words: "A concern for the glory and defense of our country should prompt such of our chemists as have talents and leisure to investigate this interesting subject. I suspect that we have much to learn with regard to this salt, so valuable in time of peace, so indispensable in time of war." The time of war was nearer at hand than he may have thought, for it burst upon us in 1812, and we were cut off from foreign supplies. Dr. Brown had estimated that what he termed the Great Cave contained 1,000,000 pounds of saltpeter; Scott's Cave, 200,000; Davis' Cave, 50,000; three others not named, 30,000. Since then the Mammoth Cave has been discovered, and the Wyandot Cave and others in Indiana, and the niter fever almost rivaled the subsequent gold fever of 1849. We have the authority of Flint's Geography for the statement that, during the war of 1812-15, the annual yield of manufactured saltpeter from Kentucky alone was 400,000 pounds, besides what was made in Indiana, Tennessee and elsewhere. Part of this was used at home; but most of it was carried by ox carts, or on pack mules, across the Alleghanies to the seaboard to be used in making gunpowder.

The term "saltpeter caves" is a misnomer only justified by the general usage. That which is found in these caves, and which is colloquially called "peter dirt," is soil impregnated with the nitrate of lime, whereas true saltpeter is the nitrate of potash.

Prof. W. B. Rogers holds that the "peter dirt" is derived directly from the overhanging rocks, which agrees with Dr. Samuel Brown's observation that the water trickling from rocky crevices has the same properties as the liquor got by lixiviating the cave clay. Dr. Brown says: "The nitric acid is formed within the caves and is condensed upon the rocks, the lime of which it dissolves."

The fact seems to have been generally overlooked that the strata of sandstone overlying the cavernous limestone is rich in niter. It was from this source that the first supplies of Kentucky saltpeter came. The process was to blast the sandrock and break it into small fragments for the boilers, thus getting niter directly without the aid of lye. The reason it was given up was that the best sandrock was extremely hard, because of the presence of iron, and it was practically easier and cheaper to treat the nitrous earth found in the caverns.

In order to give some idea of what was once a vital industry of our country, though now wholly abandoned, I shall briefly describe the work done at the Mammoth Cave, which may be taken as typical of the rest. This includes what was done at the Salts Cave and Dixon's Cave, belonging to the same estate. Dixon's Cave was, at some prehistoric time, a part of the Mammoth Cave. As measured by me it is 1,500 feet long, from 60 to 80 feet wide, and about 100 feet high. The floor of this enormous hall is ridged by eighteen transverse rocky piles some 40 feet high and as many thick, cut by passageways for convenience. And every block and fragment of those massive ridges was laid there by the old saltpeter miners. By this means they got at the peter dirt to be carried outside for further treatment.

The main works, however, were at the entrance to the Mammoth Cave. Cart roads were made through the more accessible avenues, and from the more distant places, even from rooms three miles under ground, the negro miners brought the dirt in sacks. Hardly a yard of the cave as then known was left undisturbed. Audubon Avenue was particularly rich in nitrous earth. So was Bat Avenue, near the end of which is the Crevice Pit, the ugliest black hole mortal ever looked into, and at whose bottom the men thought there must be a nitrous mine. The story has been often told of the miner's lamp dropped into that black chasm, and the sprightly negro let down as an animated plummet, who brought back, not the missing lamp, but a marvelous story whose truth was confirmed thirty years later by the discovery of the so-called Egyptian Temple. The Gothic Avenue was also diligently worked. The shovel and pick were plied from room to room of the main cave, and out through the windings of the Blue Spring Avenue. Abundant aboriginal relics were found.

The nitrous earth thus collected was put in hoppers with each a capacity of fifty bushels, and which are still to be seen in the rotunda and vicinity, a few hundred feet within the cave, where may also be seen the pumps and double set of wooden pipes, one set to bring water from the cascade at the mouth of the cave and the other to convey to the surface the liquor obtained by solution from the hoppers. The floors of the latter were peculiarly grooved to allow the saturated water to run into the basins, whence it was pumped out to the great iron boilers. When the lixiviated earth had been exhausted, it was cast aside and a new charge put into the hoppers. These piles of indurated earth extend for a long distance like miniature mountain chains. The liquor, after sufficient boiling, was poured into another set of hoppers containing wood ashes, whence, by filtration, a clear solution of the nitrate of potash was obtained. This was again boiled down to the right condition for crystallization in troughs, whence, after twenty-four hours, the crystals were taken and packed for transportation.

The proportion of ashes to be used to the nitrified liquor was a source of much perplexity. Too much would "kill" the saltpeter, and too little would leave it "in the grease;" and in either case the salts would have to be run through the hopper again. Ashes from oak are three times as rich in potash as those from pine; and only half as rich as those from elm or maple. Best of all were the ashes made by burning the dry wood in hollow trees, two bushels of which, according to Dr. Brown, were equal in strength to eighteen of oak ashes. It is stated that "the contract for the supply of the fixed alkali alone for Mammoth Cave, for the year 1814, was $20,000." That, if correct, gives us an idea of the extent to which saltpeter was manufactured here in the days when Gratz and Wilkins carried on the business exclusively for the Philadelphia market.

Many curious facts might be added as to the antiseptic and sanitary value of the atmosphere in Mammoth Cave, which is both chemically and optically pure, except as tainted by torches. None of the deep pits contain foul air. Indeed, the interior air is purer than that which is exterior, showing that its purity is not due to ventilation, but probably to the disengaging of free oxygen in the formation of the nitrate of lime, a theory advanced by Professor Silliman.

In time of peace it is cheaper to import saltpeter from Chile, India and elsewhere than to make it at home. But when the Southern Confederacy was cut off by the blockade of all its ports, it resorted to the caves of Virginia, Tennessee and Alabama, particularly to the great Nicojack Cave, near Chattanooga, for the means of making gunpowder, the process being substantially like what has already been described.

It is strange that these interesting materials of American history seem to have completely escaped the attention of our best historians. It is certainly of historic moment that, when the fate of the nation trembled in the balances, the mineral contents of our numerous caverns enabled a waning force to gather new strength, and to prolong war far beyond what would otherwise have been possible. We doubt if victory could have been won in the war of the revolution, or in the war of 1812, without the aid of the saltpeter caves of Virginia and Kentucky.

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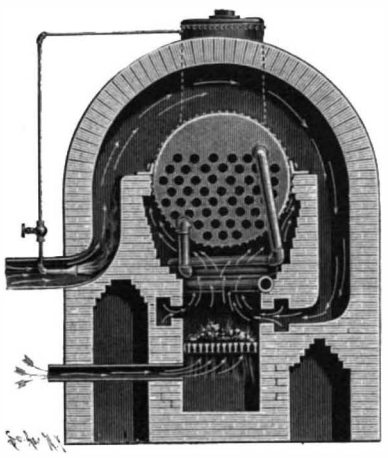
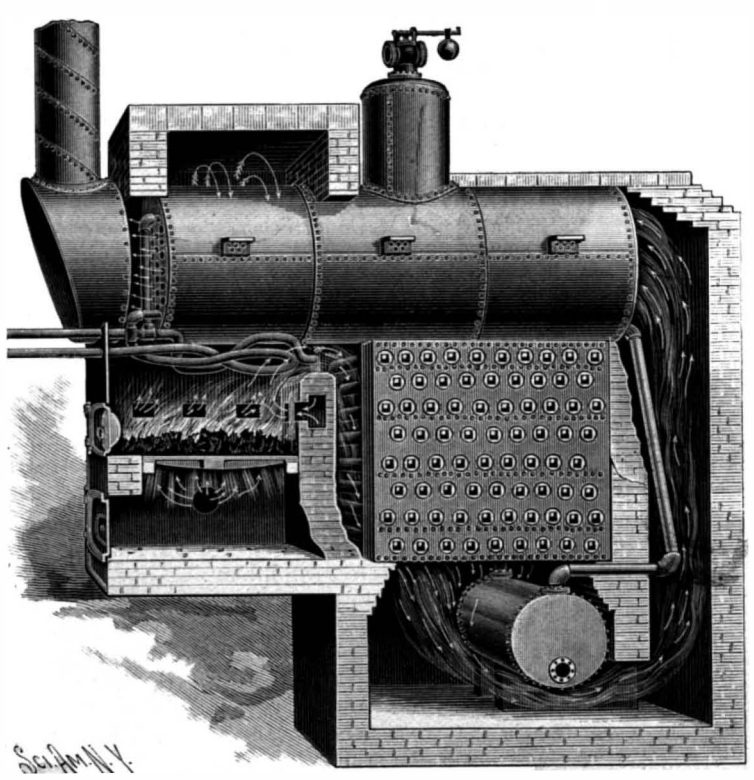
## AN IMPROVED SMOKE CONSUMING FURNACE.

The accompanying illustrations represent, in side and transverse views, both partly sectional, a furnace which is designed to entirely abate the smoke nuisance, completely destroying all smoke and gases, while also being a great economizer of fuel. It is likewise especially adapted to consume the foul air and odors generated in the cremation of garbage in gas works, slaughter houses, limekilns, and all factories and places where objectionable or dangerous gases are produced. The improvement has been patented by S. G. Smith, of No. 108 Fulton Street, New York City. The opening at the side of the ash pit, as shown in the large view, is connected with a suitable air blast, to insure an abundant supply of air for the fuel burning on the grate, the products of combustion passing over the bridge wall and backward between pendent box-shaped water legs connected by transverse tubes, and also down around the mud drum, and upward to the rear of the boiler, and thence forward to the smokestack. The feed water is taken in from the front through a pipe formed in double curves in the top of the fire box, and is thence passed through the pendent water legs and their transverse pipes, and through the mud drum, thus promoting a rapid circulation and causing the water to be heated to a very high temperature before it is fed to the boilers, the water being also purified and incrustation prevented, as the sediment settles in the mud drum. In addition to these features for promoting efficient combustion and the heating and circulation of the feed water, this furnace is provided with a special condensing and gasifying chamber which surrounds the forward end of the boiler and into which foul air, smoke, gases, etc., to be consumed may be passed by means of a pressure blower, whether they be drawn from the stack or from any other source. The foul air and gases, etc., are passed into one leg of this chamber, as shown in the small view, a jet of steam commingling with the air and gases in their course around the boiler to the point of discharge from the apertures over the grate bars, in the bridge wall and in one of the side walls of the furnace. By this means complete control may be had of all the products of combustion which might otherwise be wasted at the stack, and all foul odors from any source may be destroyed at the same time that the efficiency of the furnace is increased and a very considerable saving effected in fuel.



SMITH'S SMOKE CONSUMING FURNACE—CONDENSING AND GASIFYING CHAMBER.



SMITH'S DEODORIZER AND SMOKE CONSUMING FURNACE.

A VERY fine specimen of an egg of the great auk was recently sold by auction in London. Bidding began at 100 guineas and reached 280 guineas, at which price the egg was secured by Mr. T. G. Middlebrook.

## Discovery of Telescopic Daylight Meteors.

Prof. William R. Brooks, director of the Smith Observatory, at Geneva, N. Y., made an exceedingly interesting observation on Thursday afternoon, April 29.

While making daylight observations of the planet Mercury, then at its greatest elongation eastward from the sun, he discovered a flight of telescopic meteors passing through the field of the large telescope. This was between three and four o'clock, and the sun was shining brilliantly.

The flight lasted about half an hour, in which time over one hundred were seen.

The meteors were as bright as Vega, or other brilliant stars, when seen through a large telescope, in the daytime. The direction of their flight was toward the sun.

## Science Notes.

In connection with the general meeting of the Verein Deutscher Strassen- und Kleinbahnverwaltungen, which will be held in Hamburg August 6 and 7 next, a street railway exhibition is intended lasting from August 5 to 9.

At a recent meeting of a German engineering society, according to the Electrical World, the topic of the evening was: "Elektroautomatischensicherheitspatenteisenbahnaborthuerenverschluss." It must have been an interesting subject.

The famous Victor Emmanuel gallery at Milan is lighted in the evenings with rows of many hundred gas jets placed near the top, and the method of igniting these was an important question, says the Progressive Age. It was finally solved by using a miniature electric locomotive running on a track passing close to the burners. This locomotive carries an alcohol torch, and is made to run rapidly over the whole circuit after the gas has been turned on.

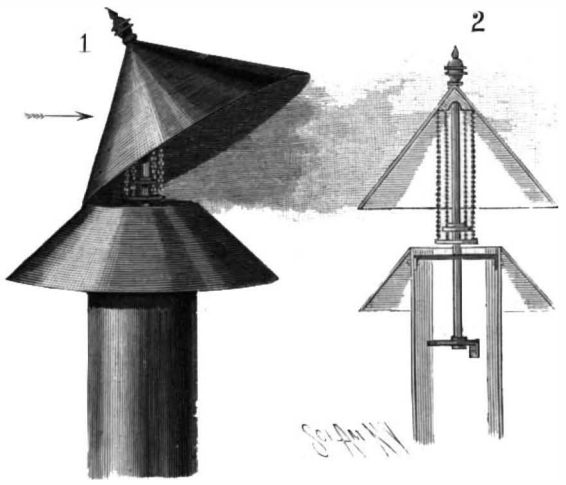
It is announced from the University of Geneva that Prof. Dussaud has invented an apparatus to enable the deaf to hear. The microphonograph magnifies the human voice in the same way that a lens magnifies. It is simply a telephone connected electrically with a phonograph, but a far more sensitive phonograph than Edison's ordinary model. A battery of one cell to sixty according to the degree of deafness, is used. Of course, the apparatus is useless in the case of absolute deafness, but such an infirmity is far rarer than is suspected. The London correspondent of the New York Sun, who describes this invention, says that 95 per cent of so-called stone deaf persons can be made to hear and understand by Dussaud's invention. Prof. Dussaud is preparing for the 1900 exhibition an apparatus which will enable 10,000 people who may all be deaf, in the common acceptance of the term, to follow a lecture.

When mine host in the ideal country inn, which all of us seek but none of us find, brings up a bottle of crusted wine covered with cobwebs and dust, this outward and visible sign is taken as convincing evidence of age. We grieve to have to record that the trust may now be misplaced. A bulletin (No. 7) of the Division of Entomology of the United States Department of Agriculture says that in France and Pennsylvania an industry has recently sprung up which consists of the farming of spiders for the purpose of stocking wine cellars, and thus securing almost immediate coating of cobwebs to new wine bottles, giving them the appearance of great age. This industry is carried on in a little French village in the Department of Loire, and near Philadelphia, where Epeira vulgaris and Nephila plumipes are raised in large quantities and sold to wine merchants at the rate of ten dollars per hundred. This application of entomology to industry is one which will not be highly commended.

Professor Forbes, who had just returned from Wady Halfa, expresses a highly favorable opinion with regard to the utilization of the power of the cataracts for generating electricity, and considers the general circumstances of Egypt exceptionally well adapted for its use as motive power, says a cablegram from the Cairo correspondent of the Times. Irrigation could be extended as well as cheapened by the saving in cattle, and especially in coal, which becomes enormously dear in Upper Egypt, owing to the expenses of transport from Alexandria. Professor Forbes considers that the cataract power would be available all the year round for working the railway, cotton ginning mills, sugar factories, irrigation machines, etc., also that it could be supplied over distances of several hundred miles at a cost much below that of coal. Professor Forbes has just left for England, but will return in September to make a complete survey and present the government with a project for utilizing the electricity to be generated at the Nile cataracts.

## AN EFFICIENT CHIMNEY COWL.

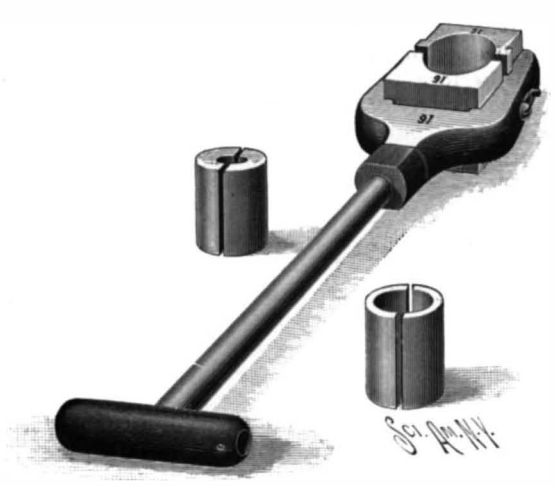
The illustration represents a simple and inexpensive chimney cowl, designed to readily accommodate itself to the wind, no matter in what direction it may be blowing. The device has been patented by August Hirschel, and is being introduced by W. H. Boatwright, P. O. Box 2296, New York City. Fig. 1 shows its application, Fig. 2 being a sectional view. The smokepipe has at its upper end an outwardly and downwardly extending flange, and within the pipe are two brackets forming bearings for the lower portion of a spindle which forms a pivot for and supports upon its upper end a conical cap. The pivot end of the spindle is received in a socket bearing on the inner side of the cap, the bearing being made of tough glass, porcelain, china, or other material of a character not likely to become quickly worn. To permit the cap to rise slightly, or yield a trifle to the force of the wind, without rising enough to cause the spindle to leave its bearing, chains lead down from the inner face of the cap to a ring loosely mounted below a collar or flange on the spindle. By this arrangement the cap will be tipped to the side presented to the wind, as shown in Fig. 1, until its lower edge engages the conical flange on the top of the smokepipe, and the wind will be deflected to either side and prevented from passing down the smokepipe, the cap remaining balanced on the spindle when there is no wind.




HIRSCHEL'S CHIMNEY COWL.

## THE HALL BRASS PIPE WRENCH.

A wrench especially adapted for use on brass or nickel plated pipes, and with which the pipes may be turned without bruising or scarring them in the least, is shown in the accompanying illustration, and is being placed on the market by the Walworth Manufacturing Company, 18 Oliver Street, Boston. Bushings for the different sized pipes, as shown in the small figures, are placed between clamping blocks, the inner one of which has limited movement within a yoke piece, through a screw threaded opening in one end of which extends the screw threaded end of a handle rod, by means of which the bushing may be clamped upon a pipe and any desired amount of friction applied by turning the handle. The clamping blocks are finished true and smooth, and with the tool is furnished a set of bushings for different sizes of pipe. The end block is held in place by a slot and pin in the yoke, but may be easily slipped in and out. The friction of this wrench is said to be so perfect that it can be used upon the most highly polished pipes without injuring them in the least, while it can also be applied to threaded brass nipples without injuring the threads.



THE HALL BRASS PIPE WRENCH.

THE Pintsch system of gas lighting has now been introduced in the Sixth Avenue trains of the Manhattan Elevated Railroad, in New York; three hundred cars have been equipped with it. It is a complete success, and a vast improvement over the old system of lighting by oil lamps. It took some years of newspaper agitation, supplemented by an act of the legislature, however, to compel the company to make the change.

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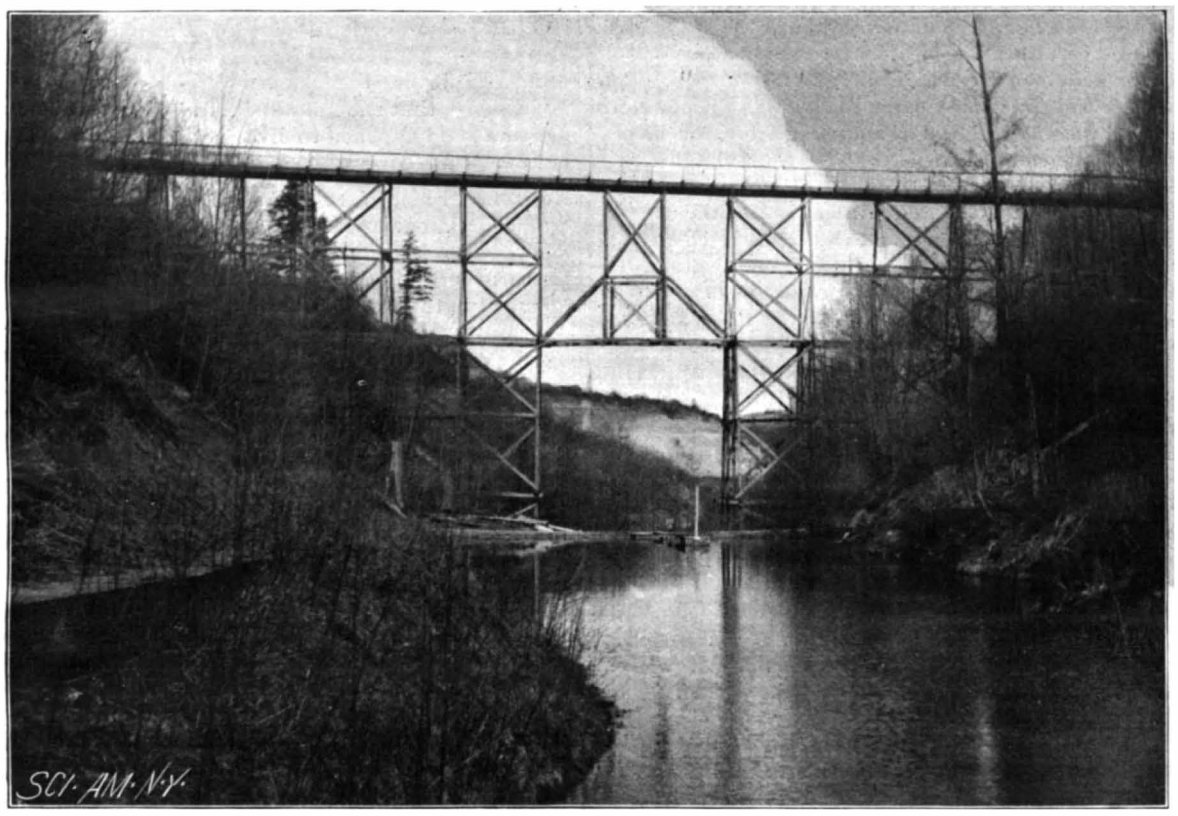
### A NINE HUNDRED DOLLAR BICYCLE BRIDGE.

Wherever you find a body of wheelmen, there you may count upon united support for road reform. Pioneer work is always difficult and expensive, and calls for a good deal of persistence to insure recognition. The bicycle craze has now penetrated every part of the country. The army of riders has invaded the South,




A BICYCLE BRIDGE AT TACOMA, WASHINGTON.

East and West, carrying the desire for better roads into every rural hamlet, so that it really seems as though the future of good roads was assured. It is very satisfactory to note that the good roads movement is not confined to the East, but is very largely in evidence in the far West.

We present an engraving of a cycle bridge at Tacoma, Washington. We are indebted for the photograph as well as the following particulars to Mr. E. Irving Halstead, secretary-treasurer of the Washington division of the L. A. W.

Many people from the East visit Tacoma every summer. A good proportion of them are wheelmen, and they were surprised to learn in the early part of 1896 that the Wheelmen's Association had decided upon the bridging of the gulch in the southern part of the city which leads to the good roads beyond. The nature of the riding district makes the bridging of the gulch of more importance than the casual visitor may imagine. The opening of the elevated cycle path, which had been built the preceding year, was the means of lengthening the cycle path, so that the riders have now four miles of excellent cycle path from the bridge direct to prairie roads. Since the completion of the bridge, which is the largest cycle bridge in the world, the wheelmen cannot understand how they managed to get to the prairie roads by the inconvenient old route. Many of the citizens were opposed to the building of a cycle path. There was an argument as to how the bicycle license money should be expended, and it was finally decided to construct the bridge. Some few hundreds of the wheelmen objected to the license being enforced; but they soon saw the benefits derived from the levy, and to-day there is not one of the 2,500 wheelmen who objects to the payment of the $1 per annum license.

The length of the bridge at the roadway is 330 feet, the height 110 feet, the width at the top 12 feet, the width at the bottom 50 feet. The trestle is built of 8 × 8 timbers thoroughly braced, the bents being 20 inches apart. The total cost of the bridge and approach was $984.50.

The management of the local road improvements at Tacoma is admirably divided between the Wheelmen's Association and the L. A. W. The former attend to all the improvements within the city limits and the L. A. W. officials take care of the outside work. The road committee is now at work with new propositions for the convenience and accommodation of the riders, and, as a result of their labors, there will be several small bridges built in Tacoma. Those constructed under the supervision of the L. A. W. will bear neatly painted signs. The wheelmen of the district desire to demonstrate their banding together for concerted action. The bridge is a fine example of what good results a little money judiciously expended could produce. It should be an incentive to those interested in good roads to prosecute the work.

THE Paris Fire Brigade authorities are said to be quietly carrying out some trials with a hose van propelled by means of a petroleum motor.

### The Phonograph in Court.

A case recently came up in a New York court where an owner, suing for damages from a railroad company for injury done his property by the noise of passing trains, sought to introduce the phonograph, and thus give to the court direct and practical evidence of the sound vibrations caused by the locomotives and cars, as they were propagated in the apartments of the plaintiff. The court did not finally rule upon the admissibility or non-admissibility of such evidence, holding the point open for further consideration as the case progressed.

### GOOD WORK IN CHIMNEY MOVING.

The accompanying illustration is made from a photograph which represents the recent successful moving of a large chimney owned by the Manhanset Improvement Company, at Manhanset, Shelter Island, Suffolk County, N. Y. The chimney is 85 feet high and 7 feet square at base, with outer and inner walls 8 inches thick; it weighs nearly 100 tons. It was moved about 950 feet over very rough ground and quite a grade, both up and down. The picture shows clearly the construction of the cradle trusses, etc. The cradle rested on two skids greased on the under side and sliding on greased blocks. The purchase used was a chain capstan, and one horse at 180 fold, and the time occupied in loading and moving was only nine days, with the labor of only four men besides the contractors, W. H. & C. P. Topping, of Bridgehampton, N. Y. The chimney was placed on its new foundation without a particle of harm. This is the second chimney of the above description moved by the same contractors. The first one was 52 feet high, at Bridgehampton, and in both cases the work was completed without accident.

### Two New York Elephants.

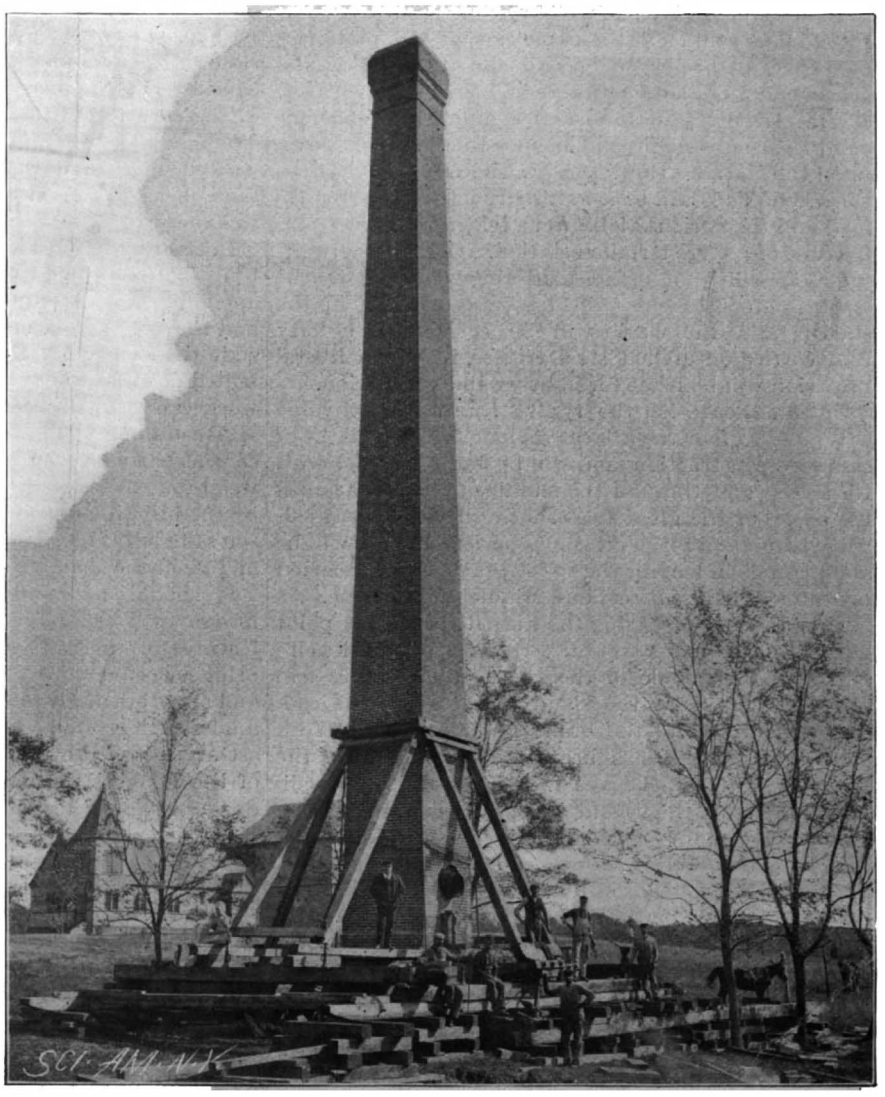
Among some animals recently received at the Central Park, New York, was a big elephant named Jewel. As the elephant was being taken through the streets to the Park, accompanied by a crowd of people at a respectful distance, and with her legs so chained that she could take only short steps, she stopped and attempted to turn back, dragging her keeper a little distance, until he stopped her retreat by tying her to an electric light pole. Thus leaving her in charge of an attendant, the keeper hastened to and obtained from Superintendent Smith, of the Park menagerie, the services of the big elephant Duchess, who was led to the place where Jewel was fastened. The two elephants trumpeted as they came in sight of each other, and then became friendly, Jewel consenting, in a few minutes, to accompany Duchess to the menagerie, where the elephants were both led without further trouble. The tractability of Duchess has heretofore been of service on many occasions, where her great strength has been found advantageous in moving many articles. It was only a few days ago that she was brought out to move a heavy truck that had become stalled by the wheels sinking in a bad place in the road, a matter which presented no difficulty when Duchess, led by her keeper, placed her great head against the rear of the truck.

### Utilization of Burned Out Electric Lamps.

It has, so far, says Industries and Iron, London, proved a fruitless task to attempt the renewal of burnt out incandescent electric lamps. Yet there appears to be some economic fallacy involved in the destruction of what is, except in one small, if important, particular, a perfect piece of apparatus. It is stated that an American firm have now succeeded in making a commercial success of a process for renewing burnt out lamps, which renders possible the use of the old bulbs at a very slight expense. By the new method the collar or base end of the lamp is not disturbed, the old filament being removed, and the new one placed through a small hole in the lamp bulb made by removing the tip. The small hole is subsequently closed exactly in the same manner as in the case of the new lamp, leaving nothing to indicate in the finished repaired lamp that it had ever been opened. It is stated that some 400,000 lamps have been repaired by this method, the filament being inserted through the small hole referred to by a skillful twist of the hand, and secured in position by a special carbon paste. The black deposit on the inside of the bulb is removed by fitting the lamp to a holder, and revolving it in a gas furnace; while, immediately following this operation, a small glass tube is fused to the opening made in the bulb, through which the lamp is exhausted. When this has been done, and the last trace of air and gas absorbed, a blowpipe flame is directed upon the throat of the tube, which is melted into a point exactly in every respect a counterpart of the original lamp.

### The Evolution of the American Locomotive.

Attention is called to the fact that a very important series of papers on "The Evolution of the American Locomotive," by Mr. Herbert T. Walker, is now completed in the SCIENTIFIC AMERICAN SUPPLEMENT, the numbers being 1112, 1113, 1114. The excellence and historical accuracy of the drawings render the series of unique interest.




MOVING A CHIMNEY AT MANHANSET N. Y.

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## THE NEW YORK AND LONG ISLAND BRIDGE, NEW YORK CITY.

We present in this issue an illustration of the great steel cantilever bridge by which the Long Island Railroad Company expects in due course to run its trains into New York City, and thereby add to the transit facilities of Greater New York. As our readers are doubtless aware, the New York Central and Hudson River Railroad is the only one of the trunk lines that possesses a terminus on Manhattan Island, and is able to land its passengers in the heart of New York without the inconvenience of a ferry trip across either the Hudson or the East River. Except the New York and New Haven Railroad, which has running privileges over the tracks of the New York Central, all the other companies are compelled to place their termini on the shores of New Jersey or Long Island, and subject their patrons to the delays and greater or less discomforts of ferry travel before they reach the metropolis itself. It was only a question of time before the problem of reaching Manhattan Island either by bridge or tunnel should be agitated, and at the present time there are three schemes on the New Jersey and three on the Long Island side for making a through rail connection. Two mammoth suspension bridges have been designed to cross the Hudson River, one at Fifty-ninth Street and the other at Twenty-third Street, and about a mile and a half below Twenty-third Street is the well known Hudson River tunnel, which has been constructed for three-quarters of the distance beneath the bed of the river. It is also proposed to make rail connection by a tunnel from the lower end of the city to Brooklyn, and by two bridges, the East River Bridge from Delancey Street, New York, to a terminus near Broadway, Brooklyn, and the New York and Long Island Bridge, which forms the subject of our front page illustration. Although all of the above mentioned schemes are primarily intended to give an all-rail connection with New York City, the bridges will in every case make ample provision for vehicular and pedestrian traffic, and will thus form important thoroughfares to link together the street systems of Greater New York.

The bridge now under consideration will carry the tracks of the Long Island Railroad Company into New York City, which it will enter between Sixty-fourth and Sixty-fifth Streets. A great terminal station will be built on Manhattan Island which will cover the entire block bounded by Second and Third Avenues and the streets above mentioned. The station will be 610 feet long by 200 feet wide, and the platforms will be 54 feet above the street level. The basement will be occupied by the machinery for elevators, etc., and by a large cold storage plant, the space devoted to cold storage alone comprising 480,000 cubic feet. On the ground floor there will be stores, a large restaurant, and a central hall 50 by 70 feet, facing which will be six large elevators, each having a floor space of 150 square feet. Behind the elevators will be two express rooms. A covered carriageway will lead from Sixty-fourth to Sixty-fifth Street. The space from the carriageway to Second Avenue will be given up to a market. The second floor will be at the same level as the platforms of the elevated roads on Second and Third Avenues. It will contain a large entrance hall 50 feet by 150 feet, several large restaurants, and a number of spacious galleries from which it will be possible to look down upon the market below. Above the entrance hall on the second floor will be a waiting room, 80 feet by 175 feet, and the various ticket and telegraph offices and bureaus of a large terminal station. Outside the waiting room will be a broad platform extending to the track buffers. There will be twelve tracks in the station, and the whole will be covered by a lofty roof, carried on arched steel trusses, in which liberal provision will be made for lighting and ventilation.

Outside the station the twelve tracks will converge to a massive four track steel viaduct, which will be of standard construction, and will be built parallel with the streets and through the middle of the blocks until the portal of the great western cantilever is reached. The viaduct approach on the Long Island side will be about a mile in length, the street grade being reached probably at Hulse Street and Middleburg Avenue.

The problem of crossing the East River at this point is greatly simplified by the existence of Blackwell's Island in the middle of the river. By locating two piers on each side of the island, and placing the cantilever piers close to the bulkhead lines of New York and Long Island, it has been possible to reduce the length of the channel spans to 846 feet, the intermediate span across the island being 613 feet in length. The bridge is built on the cantilever principle, and in its outline it will remind our readers of the high level bridge across the Hudson River at Poughkeepsie. The likeness is merely one of general outline, for in respect of weight and size the present structure will easily outrank every bridge of the kind in America, and, with one exception, in the world. The Forth Bridge, in Scotland, is the largest cantilever structure in existence, its two channel spans being 1,710 feet in length, and it is likely to remain forever the longest, for the reason that when the distance to be bridged exceeds 1,200 feet it is found that sufficient rigidity can be obtained in a stiffened suspension bridge—a type that costs considerably less than the cantilever, especially in bridges of exceptional length of span.

The bridge is made up of two cantilevers, each 500 feet long, one on the New York and the other on the Long Island side, a deep parallel truss across the island with overhanging cantilever arms at each end, and two intermediate spans, each 350 feet long, suspended above each channel. Perhaps the most striking, and certainly the most handsome, feature will be the six massive piers which carry the structure. Four of these will practically carry the whole of the weight, the end piers being used as anchorages for the inshore arms of the end cantilevers. The four channel piers measure 45 feet by 85 feet at the base, and will be carried up to 135 feet above high water, the requirements of the War Department calling for a clear headway of 135 feet below the bridge at high water. The foundations are carried down to solid rock, which has been found at from 20 to 50 feet below mean tide. As will be seen from the illustration, they are of very massive appearance, the four channel piers containing 810,000 cubic feet of Connecticut granite, and the two anchor piers 216,000 cubic feet of the same material. It was originally intended to carry the piers up solid from foundation to capstone, but subsequently the design was changed by piercing the center with an arched opening—a modification which will add greatly to the architectural appearance of the whole structure.

The trusses will be of the well known pin connected Pratt type with divided panels. They will be placed 56 feet apart and the space between them will be occupied by four lines of track, those which are laid next the trusses being used for local trains and the other for express service. The floor system will be of the standard type, consisting of deep plate steel floorbeams, riveted at their ends to the posts and vertical ties, with plate stringers, riveted to and between the floorbeams and extending the full length of the bridge beneath the rails.

On the outside of each truss is a wagon way and a six foot sidewalk, the sidewalk rails forming the extreme outside line of the bridge. This will be carried upon cantilevers or brackets, which are in reality extensions of the floorbeams. From the ends of the bridge the wagon ways will descend on a regular grade to the street level, and here they will be carried by the posts of the viaduct to which the brackets are riveted, as shown in our illustration.

The total width of the bridge outside the footwalks will be 98 feet. The greatest depth of the trusses will be 100 feet, measured from center to center of pins, and the total height of the top chords above high water will be 235 feet. The total length of the whole structure between terminals will be two miles. Thirty-six thousand tons of steel will be used in the superstructure, and the estimated cost of this great work, including the terminals, is $8,000,000.

It can well be imagined that the various members of a bridge of this size will be of exceptional size, and perhaps the best idea of this is conveyed by the dimensions of the steel pins which transmit the weight of one cantilever to the piers. Each of these is 20 inches in diameter, 9 feet 6 inches long, and weighs four tons. The many eyebars and compression members that are packed snugly against each other at this point represent, therefore, a solid mass of steel nearly ten feet in thickness.

In erecting the bridge, temporary falsework will be built between the two island piers and between the anchorage and river piers. Upon this the island span and the two shore arms of the cantilevers will be erected in the usual way. The ends of the shore arms will be bolted down to the anchor piers. The temporary falsework can then be removed, leaving the trusswork self-sustaining. The river or channel arms of the cantilevers can now be built out over the river, the weight of the overhanging parts being counterbalanced by the inshore portion. The center truss is built in the same way, the junction being finally made at the middle of the span.

It should be mentioned in conclusion that the bridge will embody in its construction the best features of the pin connected and riveted systems of bridge construction. The whole of the massive wind and sway bracing will consist of built up plates and angles with riveted connections to the trusses.

Our thanks are due to Mr. A. C. Bedford, treasurer of the Long Island Railroad, for courtesies extended during the preparation of the present article.

## A Copyright Decision.

Amberg File and Index Company v. Shea, Smith & Company, 79 O. G., page 514. An index for the storage of letters is not proper subject matter for copyright. It is not a book within the meaning of the word in the Constitution, since by itself, that is, without the letters for which it is used, it forms no medium of information or intelligence. Nor is the inventor of such an index an author as that word is used in the Constitution. A monopoly for the index might perhaps have been secured under the patent laws.

## Recent Patent and Trade Mark Decisions.

Imperial Chemical Manufacturing Company v. Stein (U. S. C. C. A., 2d Cir.), 77 Fed., 612.

Neglect to Sue for Infringement.—The patent in this case was for a process of dyeing hair and the chemical preparations constituting the dye bath. The defendant sold the patented hair dye for about fifteen years in New York City, during which period of time it seems that the owner of the patent lived in that city but did not protest against the infringer of the patent. The failure, however, to make such protest when there is no evidence that she knew of the infringement, excepting that she happened to live in the same city, should not defeat a recovery for the infringement.

Newton v. Buck (U. S. C. C. A., 2d Cir.), 77 Fed., 614.

Sale of Patent by a Receiver in Proceedings Supplementary to Execution.—Buck transferred, in writing, to a firm certain patents, but, accidentally, one patent included in the agreement was omitted in the writing. Afterward all rights under the agreement were assigned by the firm to Newton. Then a receiver of the property of Newton was appointed by the State Court in proceedings supplementary to execution. By order of the court the receiver sold Newton's interest in the omitted patent and the purchaser transferred the same back to Buck. The equitable title that Newton held in the omitted patent by the receiver's sale passed to Buck and a subsequent assignment thereof by Newton passed no interest.

Muller v. Lodge & Davis Machine Tool Company (U. S. C. C. A., 6th Cir.), 77 Fed., 621.

Increase of Efficiency Ground for Patentability.—If an inventor has greatly increased the effectiveness of a mechanism, his patent will be sustained although his elements are old and no origiual results are accomplished. The patent in controversy was on a tool holder for lathes. The patentee had arranged old elements in such a way that by a conjoint use of two nuts he much improved the effectiveness and accuracy of old devices serving the same object. The patentee is not only entitled to the conjoint use of the two nuts in combination with the rest of the device claimed, but also to the benefit of every suggested conjoint use of these nuts which adds to the effectiveness of his mechanism, although not claimed as within the purpose of the invention.

Limitation of Claims.—If the invention patented is not a pioneer or primary invention, and reference letters be used in the claims, they will be limited specifically to the combination of all the elements specified; but if the invention be broad and meritorious, working a decided advance in the art, it will require something more than the use of reference letters in the claims to limit them to the exact form of device described.

Tool Holders for Lathes.—The Muller patent, No. 272,304, must be limited, as to claims 2 and 4, to the precise structure claimed by reference letters and the patentee is not entitled to a liberal application of the doctrine of mechanical equivalents.

Steel Clad Bath Company v. Mayor, Lane & Company (U. S. C. C., N. Y.), 77 Fed., 736.

What Amounts to Invention.—The fact that one is the first to produce an article having features long desired, that he has succeeded where many others failed, entitles him to a patent; and this fact, even if there are doubts as to novelty, should resolve the question in his favor. On this ground a claim for a bath tub composed of a smooth sheet metal casing having a lining of copper, aluminum, etc., pressed into close contact therewith, is valid and is infringed by a tub in which an asbestos sheet of very slight thickness is placed between the casing and lining.

Bath Tubs.—The Booth patent, No. 458,995, has been held valid.

Repairing a Patented Machine.—The fact that a device is patented does not prevent the owner from putting it in order when it gets out of repair, but when it is accidentally destroyed or is practically worn out, the owner cannot make a new machine under the guise of repairing it.

Goodenough v. Cary (U. S. C. C., N. Y.), 77 Fed., 827.

Lacing Studs.—The Mathison patent, No. 525,152, for an improvement in lacing studs whereby nonmetallic, plastic metals, such as hard rubber or celluloid, may be fastened to the heads thereof by attachment to a crimped or corrugated flange, has been held void as lacking invention because it was like the old studs in every way except that the celluloid is held in place by minute depressions and elevations called crimps, instead of by minute depressions or elevations called lips.

Berry v. Wynkoop-Hallenbeck-Crawford Company (U. S. C. C., N. Y.), 77 Fed., 833.

Money Checks.—The Berry patent, No. 268,988, for an invention consisting in providing checks or other papers representing money values with marginal tables of figures to be torn off so as to prevent raising or altering the amount, is void for want of invention over the prior art, especially the Stanfield 1873 patent.

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### The Sun and His Relations to the Earth as Parent, Ruler and Energizer.*

The sun is the most glorious of all objects. Swedenborg made the sun, in his system, the correspondent of the Deity; the agent by which power and life were given to the inhabitants of surrounding worlds. Of all the energy that keeps things moving on earth, 99 per cent comes from the solar heat. The meteors help and the moon gives us tides; but 99 per cent of all the force that moves our mills, actuates our own hands and voices, comes from the solar rays. If the winds blow, it is because of some disturbance in the air. What is the cause? At some point or other the air is unequally heated; masses of air rise; other portions rush in to take their place and you have winds established. If Niagara does not run out; if Lake Superior does not find its way permanently to the ocean; if the Delaware does not stop running; it is because somewhere or other there are pumps running that lift the water back to the source, and those pumps are in the sun's rays. The constructor of the first steam engine says it is "nothing but bottled sunshine." What built the carbon in the stick of wood from which we derive heat? Simply the solar rays putting the elements of wood together in a certain way, and when you burn the stick you are allowing the hydrogen to resume its old combination with the oxygen from which it has been separated before. The power that actuates results is solar power, because derived from the food built up by solar rays. If you use a galvanic battery, a zinc and carbon battery with acids in it, how was the acid got out of its combinations and put in such shape you could use it? If you trace back the chemical processes by which we get these things used in a battery, they were put in shape by the solar rays. If you leave out the heat coming from the stars (as much in a year as the sun gives in a second), and the heat from the meteors (about as much as that), and all the tidal power, all the rest is sun power.

I am speaking within a quarter of a per cent when I say the sun is about 93,000,000 miles away—12,000 times the diameter of the earth; so that the quickest railroad train, on a schedule of 60 miles an hour, would be 175 years on the journey. New York is a little better off than Pennsylvania for cheap railway fares, so that at two cents a mile it would be a little over one and three-quarter millions of dollars.

The unit employed in measuring star distances is 63,000 times the distance from us to the sun. Stellar distances are vastly greater, and our sun is no greater than any other sun. Our sun has a diameter of 860,000 miles, or $\frac{1}{110}$ part of its distance from us. The quantity of matter in it is 330,000 times that of the earth; the force of gravity upon it is twenty-seven times what it is here, so that a small man like myself would weigh about a ton, supposing there were life there. The average density of the sun is only a quarter part that of the earth. It averages a little more than the density of water. In all probability we don't see the sun itself at all; what we see is a great shell of cloud that overlies and covers it and sends out light and heat in somewhat the same way that the mantle of a Welsbach burner radiates light and heat from the gases within. The explanation of this low density is the intense heat of the sun. The temperature we don't know. The investigations of the past ten years show it to be between 10,000 and 20,000 degrees Fahrenheit, and probably not very far from 14,000 degrees. The effective temperature is no more than a thousand degrees one way or the other. The furnace in which our French friends make diamonds is possibly six or seven thousand degrees; but this double temperature indicates a vastly increased radiating power.

What is the temperature of the earth? Do you mean the temperature of the North Pole, at the equator, at the top of mountains? There isn't "a" temperature of the sun. On the whole, it acts as if it were a body covered with lampblack heated to a certain temperature, and we call that the "effective temperature." At a very small depth within the solar surface the temperature rises, rises, rises—just as it does as you descend in the earth. Then how is it that its temperature is maintained? The probability is that the temperature is maintained by the continuance of a process going on age after age—the process by which the worlds were made—the system that surrounds the sun. We are quite sure that it is not produced by any action of combustion in the first place. If so, I cannot stop to explain how the calculation can be made, but long ago the sun would have burned out. It could not last but about six thousand years in all. Neither can it be simply a warm body cooling and bringing the heat from inside to the outside and throwing it off by simply cooling as a ball of iron; it would not last long that way. Some have suggested that it was produced by the rotation of the sun, that the sun's heat is maintained by a sort of an electric arrangement like a Holtz machine; but it is very easy to calculate that no heat is produced in that way, that there is a hang back to the sun, just as power is required to drive a dynamo machine; and the sun's rotation would have been stopped, on that basis, in five hundred years. Then there is the older idea that the heat is produced by meteors falling on the surface. When Tyndall wrote his book upon the "Mode of Motion" the theory was maintained in that way. The idea was that the meteoric matter falling upon the sun might account for the radiation of the heat. A mass as large as the earth falling upon the sun with the velocity that the earth would acquire in dropping that distance would supply the sun for a hundred years. But Venus and Mercury say no! If there were any such quantity of meteoric matter near the sun, their orbital motions would be different. The earth would get as much heat from the meteors as it did from the sun. Helmholtz suggested about 1853 that the sun's heat is maintained by its slow shrinkage. Supposing I hold a book in my hand and drop it on the floor, what happens? Gravity acts upon it, with a little noise; but the main thing is, the book is warmed and the floor is warmed. Motion has been produced and has been stopped, and a certain amount of heat unquestionably produced. If we put a hole through a weight and put it on a post, and let it slide down, it would produce heat also. Suppose every portion of the sun's surface drops 150 feet toward the sun's center, diminishing its diameter about 300 feet; in that case, on any reasonable hypothesis of the constitution of the sun, that would account for all the heat the sun sends forth. If the sun continued shrinking faster than that, it is growing warmer; if it is shrinking more slowly, it ought to be cooling off a little. The sun is giving out 30 calories of heat for every square meter of its surface, which would heat 30 kilogrammes of water one degree every minute—equivalent to about 2¼ horse power energy. If, by some means or other, we could case the sun in with ice 60 feet thick and then let the heat start, it would be just one minute melting off. A yearly shrinkage of 300 feet in diameter of the sun would have to go on for 7,000 years before detection by the best telescopes that we or our posterity are likely to possess; and it could go on from seven to fifteen million years without disturbing anything; but the end will come; though just here we meet with a difficulty with reference to the past history of the system. The geologists want more time for the making of the solar system by the processes that seem to be indicated by the nebular hypothesis.

If the sun is throwing off heat alike in all directions, I do not think it can possibly be more than 150,000,000 years old. Can it be that energy is expended only in radiating from the sun to another material body? The whole solar system does not receive more than two-thousand-millionth of the heat that the sun radiates. It goes off into space. Our hundred millions of possible life for the solar system might easily become a million millions if it only loses heat when it gives it to something else.

Several diagrams were thrown upon the screen illustrating the nebular hypothesis of development of the solar system. By means of the actinometer the heat of the sun's rays is measured, though we do not know how much to allow for absorption by the atmosphere. The Wilson & Gray (1894–95) radiomicrometer is the most delicate apparatus yet devised for sun heat measurements. At the Columbian World's Fair of 1893 was shown a great reflector made of boiler iron lined with mirror glass, projecting light and heat that ran a two horse power engine as long as the sun would shine. The invention was Ericsson's, who had a great idea of the value of the sun's rays in Egypt and other such countries where the sun's rays could be depended upon constantly. Our best steam engines do not give one-sixth the power originally shot off from the sun, stored in the coal, and finally brought under the guidance and control of man as issuing from the steam engine. The general surface of the sun is at least 5,000 times as bright as the lime light and not more than four or five times as bright as the electric light you are using to night. The lime light is an intense jet black when held against the solar surface.

Sun spots are a very interesting phenomenon. One of the largest spots observed was over 100,000 miles in diameter. Sometimes spots do not last more than a day or two, and the Methuselah of the race lived eighteen months only. They very rarely last over a year. They do not lie below the sun's surface, on which they are a sort of a boil. Meteorologists have been discussing a theory of cold waves—spots formed by congealing taking place at certain portions of the solar surface; from certain portions of the material they rise and are congealed in rising. Usually the sun spots are cooler than the surrounding sun. The center of the sun spots gives usually not more than a quarter as much heat as the surface surrounding it; but when you get near the edge of the sun, they actually are hotter than the surrounding photosphere. The spot of 1893 appeared in connection with the great electric storm, when the telegraph lines worked without batteries for a whole day; and this great spot, just about the size of the earth, broke out just about the time of the occurrence of this electrical storm, one of the coincidences between a great solar disturbance and a great magnetic disturbance on the earth's surface.

We do not know the cause of the spots. Now they are rare and again abundant. The average interval is about eleven years. They were exceedingly numerous in 1872, almost disappeared in 1880, but in 1884 there was another maximum. There is no regularity about it. Nobody knows what makes the slight approach to periodicity of their occurrence. Do these variations in the sun spots affect the earth? Some consider them causes of storms, some, of disease (cholera for instance), some, commercial crises; all sorts of happenings are laid to the account of sun spots; but, as far as I can make out the evidences, the line of magnetic storms corresponds with the sun spots. If you watch the magnetic needle, you find it keeps swinging back and forth and at times will dance about for days at a time. And we call that a magnetic storm; for some reason or other the magnetic conditions of the earth are disturbed and the magnet vibrates. Some observers watch this change constantly, and records are kept.

In years of numerous sun spots, magnetic storms and the aurora borealis appear frequently, but the connection we cannot account for. We do not know if they be cause and effect. They go together. It is entirely possible that the disturbances are altogether from outside and affect the sun and the earth together. Each new accession of sun spot activity breaks out on one side of the sun's equator or the other. They move in well-defined zones.

When we look at the solar spectrum, we get a great multitude of diagrams. Fraunhofer discovered this in 1816, the Fraunhofer's lines being dark streaks across the spectrum. Prof. Young described the significance of these lines. The burning of gases produces beautifully brilliant spectra; but where you have a solid or a liquid you have a spectrum that is continuous—no markings. The explanation of these dark lines in the solar spectrum is that these photosphere clouds have an atmosphere of gases over them, and when the light from that photosphere passes through that atmosphere, then those lines turn dark. In the eclipse of the sun shown upon the diagram at the moment when the moon had covered up all the sun except this edge, the lines that had been dark before turned bright, and remained bright about a couple of seconds and then faded away. In getting the iron spectrum, the iron is not simply warm—not simply melted—but it is actually boiling, and the iron vapor is just like the steam from the tea kettle, and in that condition it gives a bright light, and then you could compare the spectrum of the sun with that of the iron and see if there is any iron in the sun. Two slides were exhibited giving the close resemblance of the iron and sun spectra. Rowland's concave grating spectroscope is the best extant. The spectrum of a sun spot shows that the darkening is due to the presence of cooler vapors in which vanadium is abundant. A blowpipe blister in a spectrum of the sun was due to a sudden blast of hydrogen gas moving 160 miles a second. A prominence of 200 miles length rose up from the sun's surface on one occasion.

During an eclipse occurring in 1882, visible in Egypt, and of which photographs were taken, a comet was seen for just two minutes, to which was given the name Tewfik, being that of the then ruling Khedive of Egypt.

*Condensed for the SCIENTIFIC AMERICAN from a lecture at the Drexel Institute, Philadelphia, by Prof. Charles A. Young, professor of astronomy at Princeton University.

### The Bicycle Wood Rim Patent.

In a recent decision in a case before the United States Circuit Court for the Northern District of New York, Justice Coxe sustained the Fairbanks and Berlo patent of May 9, 1893, on wood rims for bicycle wheels. The great popularity which these rims have attained within a year or two renders this decision especially interesting. The patent is for a rim composed of a series of sections or plies of wood of varying course or direction of grain, cemented together, the ends of each section breaking joints with the ends of adjacent sections. The court held that "the introduction into the art of the marked and at the present day universally recognized improvement of the patent required an exercise of the inventive faculties. . . . Carriage wheels with the ordinary compression spokes and reinforced with iron tires had been made with laminated fellies, but there is no pretense that the break joint and varying grain features of the patent are found in any of these structures, which are not adapted for use in a wheel provided with suspension spokes and pneumatic tires. . . . The patentees have done much to make the modern bicycle a perfect machine."

DR. WM. T. BULL, says The Independent, has lately given to the world an account of the entire restoration to health of a woman who had carried a plate for artificial teeth in her esophagus for twenty-two months, her health meantime being at a low ebb, for the removal of which he successfully operated. In that connection he relates some most interesting experiments with the X rays. It seems that there are many things that may be swallowed—one surgeon enumerates twenty-five that have been—and more than half of them are substances that can be discerned by the aid of the X rays. Hence he considers that "this addition to surgical resources cannot be overestimated."

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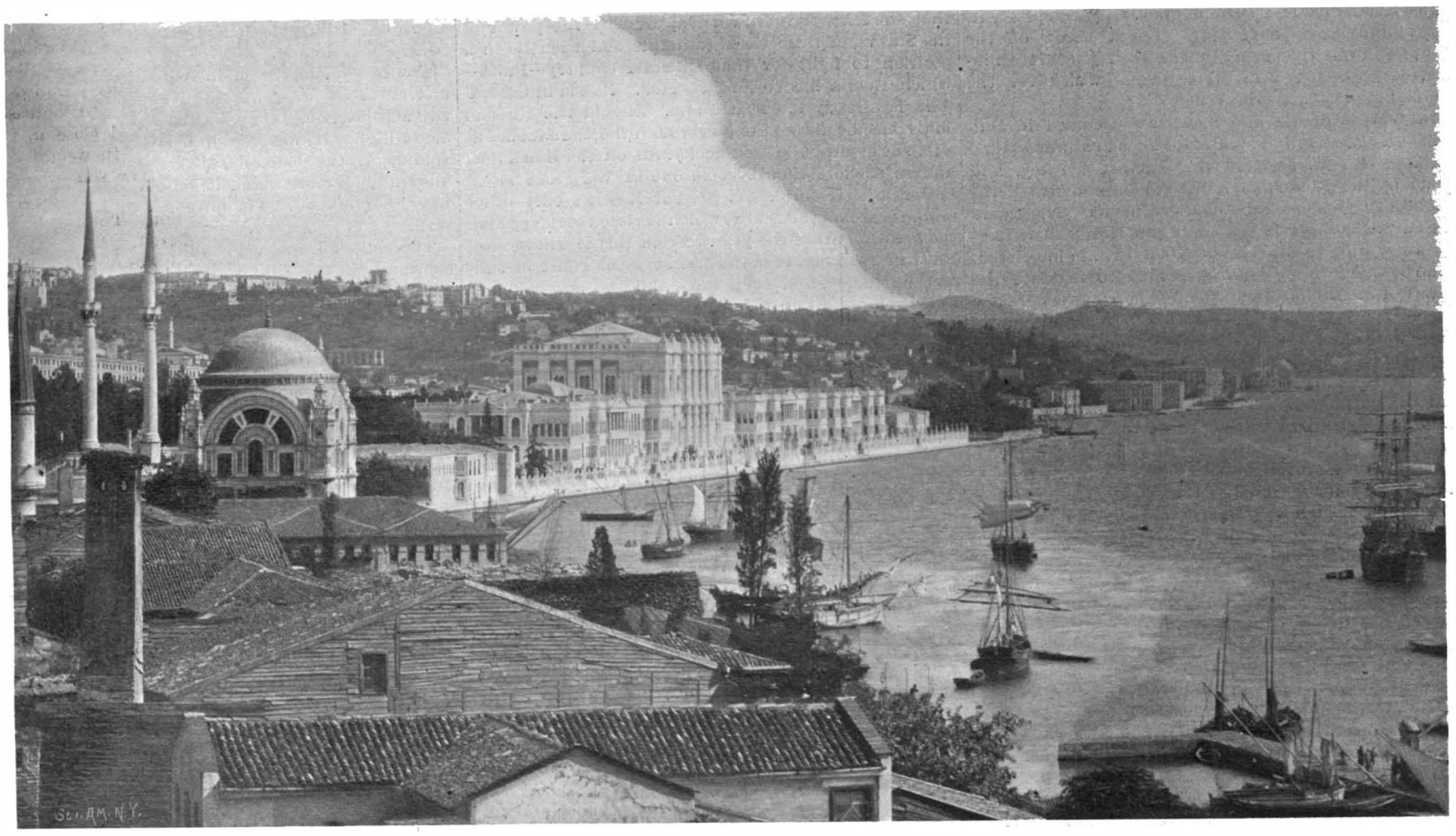
of the line was reached just as the sun was crimsoning in the west, and thus was brought to a close one of the most stirring marine spectacles ever witnessed by the city of New York.

## THE WAR IN THE EAST

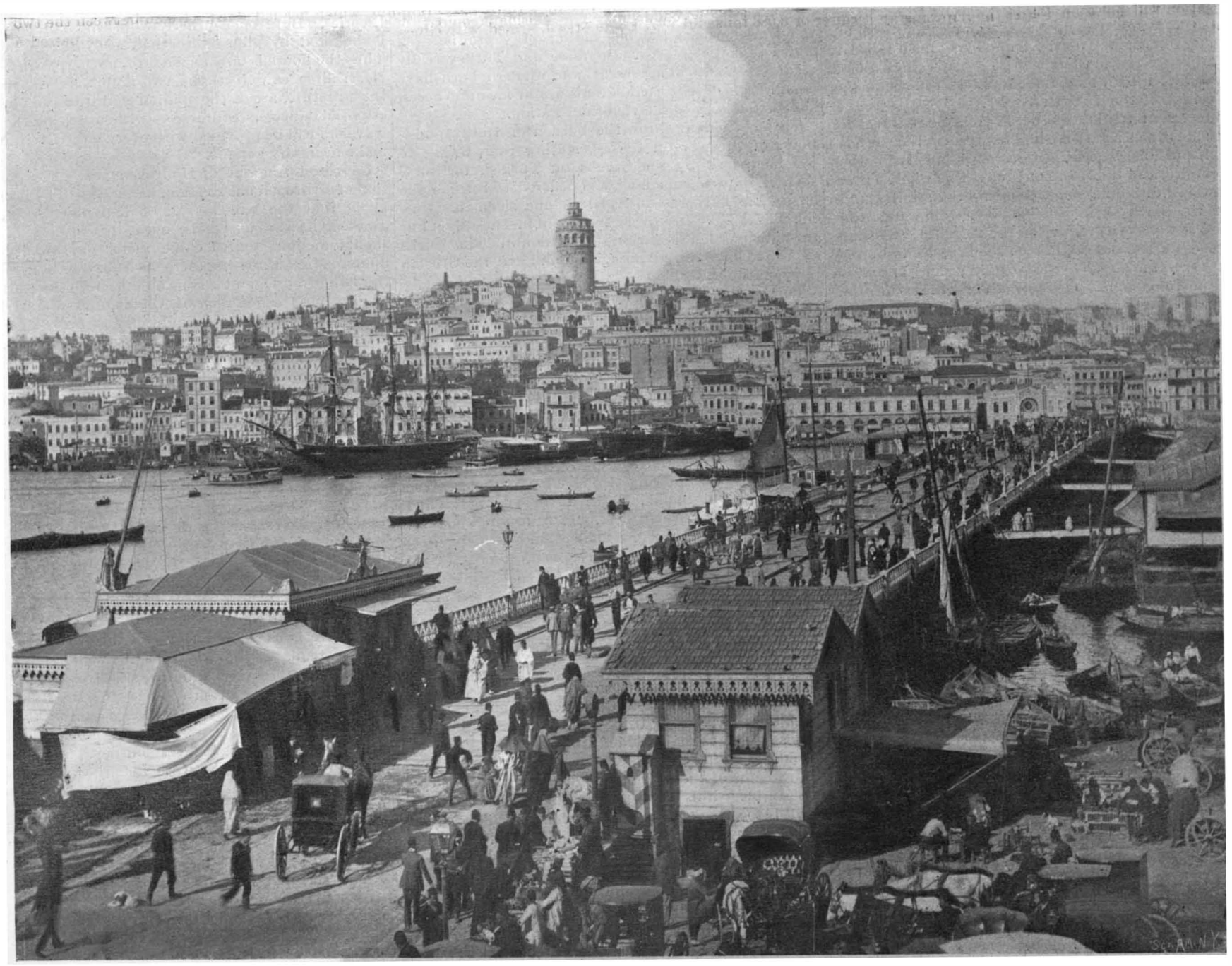
The daily press has kept our readers well informed of the progress of the Greco-Turkish war. A struggle which involves the conflicting interests of so many nations is of such unusual interest that we will attempt to give a brief analysis of the "Eastern question" and the fundamental causes of the present Greco-Turkish war.

The birthplace of the Ottoman empire was Sugud, on the Sakaria River, for here was born the illustrious Osman, from whom the whole tribe took its name. It is from this we get the name "Ottoman." Osman enlarged the holdings of his people in Asia Minor, and in 1358 crossed the Dardanelles and seized Gallipoli, on the European shore, this being their first foothold in Europe. Constantinople fell into the hands of the Ottomans in 1453 and Greece in 1477. Three years later they gained a footing in Italy, at Otranto, and in the next century Syria, Egypt and Arabia fell into their hands.

Under Suleiman the Magnificent, who lived from 1520 to 1566, the Ottoman empire was at the height of its power, and included not only the entire Balkan Pe-



CONSTANTINOPLE—DOLMABAGHCHI PALACE ON THE BOSPHORUS.



CONSTANTINOPLE—GALATA BRIDGE CONNECTING GALATA AND STAMBOUL.

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ninsula, but Hungary as well. Under his son, the empire began to decline. In the eighteenth century several attempts were made to partition Turkey, but they were not entirely successful, though parts of the territory were pared off from time to time.

Greece won her independence in 1828, and by the Treaty of Paris, Turkey was placed under the tutelage of the other powers, especially Great Britain and France. In 1866 Moldavia and Wallachia united to form Roumania, and became practically independent, as did Servia the next year. Egypt threw off the bonds and was then ruled by khedives. In 1874 an insurrection occurred in Herzegovina, which set the whole Balkan Peninsula on fire.

In 1875 outbreaks and massacres occurred in Bulgaria; and Servia and Montenegro declared war against Turkey. Russia declared war against Turkey, and aided by the Roumanians, the Russians defeated the mighty Turkish general Osman at Plevna. The treaty of San Stefano in 1878 was made, practically surrendering everything to Russia, but Great Britain interfered, and the Congress of Berlin was held to regulate the affairs of the Balkan Peninsula. The congress greatly altered the conditions. Roumania, Servia and Montenegro were made absolutely independent, while Bosnia, Herzegovina and Novi Bazar were put under Austrian administration, part of Thessaly was ceded to Greece, and Bulgaria was made autonomous. Turkey in Europe was really restricted to a narrow strip from the Bosphorus to the Adriatic. Sultan Abdul Hamid II succeeded to the throne in 1876. He came to the throne at a critical time. Years of evil rule had engendered the corruption which always seems synonymous with the name of Turkey. His efforts for reform met with no encouragement from the Powers; then came the Russian war, with the loss of several important provinces; each power seeking its own selfish gain without regard to the Turkish rights. The Powers are never weary of reminding the Sultan that his empire exists only on sufferance. The Sultan has been the victim of bad policy which has been fostered by one or the other of the interested Powers. Thus, for instance, all the Christian inhabitants of Turkey were to be put under Russian protection, but England was jealous of Russia's power, joined with France, and compelled the treaty to be dropped. The result of this grabbing of the Powers was that England has practically possessed itself of Egypt and Cyprus. Roumania and Servia are independent kingdoms, Bulgaria is virtually independent, Austria has occupied Bosnia and Herzegovina, Greece and Montenegro have been aggrandized, but nothing but some "frontier trimmings" have fallen to the lot of Russia, so there is little wonder that Russia now insists upon taking a dominant part in the further disposition of the Turkish empire.

The present attitude of the six great powers is as follows: Russia means to recoup her losses in the Crimean war, if possible, by seizing Constantinople, the bulk of the empire, and the island of Crete. She wants Thrace with Constantinople, so as to control the straits and to make the Black Sea a Russian lake. She wants Albania, so as to have a frontier on the Adriatic; she wants Crete as a naval station, in fact there seems to be very little that this already great country does not want. Austria-Hungary has virtually absorbed Bosnia, Herzegovina, Novi Bazar. Now she only wants a strip across Macedonia so as to make Salonica her own seaport on the Ægean Sea. Great Britain appears to have renounced her old policy of opposing Russia and now seems willing that the latter should do about as she pleases. Having a good hold on Egypt, which is one of the keys to India, and with Malta and Cyprus in the Mediterranean, she ought to be content. Italy follows the lead of Great Britain, and appears to have no ax to grind except, possibly, to see Montenegro enlarged, as this country is the native land of the Princess Helene, wife of the Crown Prince of Italy. France follows the lead of Russia and keeps an eye upon Syria as the share of the "sick man's" effects which she would like best. It is hard to say what the policy of Germany is. At present it appears her attitude is governed by spite against Greece, because the German Emperor's sister changed her faith to that of the Greek church when she married the Greek Crown Prince, without asking the Emperor's permission. This is, therefore, the so-called "concert of the Powers." It is difficult to see how the interests of all can be adjusted without a general European war should the Ottoman empire go to pieces. At present each is engaged in blocking his neighbor, while to all appearance they are attempting to preserve the integrity of the Ottoman empire. This cry of the preservation of the integrity of Turkey is entirely insincere. When it has suited the purpose of the Powers, they have not scrupled to encroach on the sacred territory. In the Fortnightly Review for April, Sir George Baden Powell gives this instructive table of the area and population of Turkey in Europe at different periods in the present century:

| | Area Sq. Miles. | Population. |
|---|---|---|
| 1817 | 218,600 | 19,600,000 |
| 1857 (after treaty of Paris) | 193,600 | 17,400,000 |
| 1878 (after treaty of Berlin) | 120,560 | 9,600,000 |
| 1897 (to-day) | 81,200 | 6,300,000 |
| Excluding Bosnia and Herzegovina under Austrian rule | 57,000 | 4,700,000 |

This comparison shows that Turkey has in Europe to-day only about one-fourth of the area and less than one-fourth of the population that she had at the beginning of the century. The rest has been appropriated by the very Powers which are now declaiming about the necessity of maintaining the "integrity of Turkey."

The reason why England is always so anxious when the Christian subjects of Turkey are in rebellion is that she fears that Russia may destroy the power of the Sultan, capture Constantinople and then be in a position to fight for that splendid country—India—which Russia has so long coveted. Russia in Central Asia is already too near India. Should the Russian ships once be allowed to go through the Dardanelles at will, she could build vast dockyards on the Black Sea, and in a short time become one of the great naval powers of the world. At present Russia's only other seaports are on the Baltic, which is closed to navigation the greater part of the year. From this it will be seen that the few miles of water has been the cause of endless diplomacy, and even wars, and the possession of the strait might in a few years change the political divisions on our maps.

As we have already stated, the Greeks won independence in 1828, but the Greece of 1828 was simply the nucleus of the nation to be. It is the growth of that nucleus that the Cretans and Greeks are fighting for. The liberation of another section of the three or four millions who are still held in Turkish bondage is only another step toward the unification of Greece. Greece does not claim the privilege of settling the Eastern question by itself, but does emphatically claim the right to aid other Greeks to throw off the yoke of an intolerable despot. The government of the monarchy is, to a very large extent, a popular one, so that the Kaiser and Czar naturally do not regard it with favor. The Greeks are justified in fighting for freedom whenever the opportunity offers. Under Mohammedan rule no Christians can ever enjoy the degree of political rights that Mohammedans possess, and though the modern Greeks have very little of the old Hellenic blood in their veins, still they will always be recognized as a patriotic and freedom-loving people. Things at last reached such a pass in Crete that Greece could not, with self-respect, stand by quietly any longer and see her brothers suffer. So troops were sent into Crete. Then came the now well-known blockade of Crete; this the majority of the Italian, French and English people cordially condemn. The mismanagement of the Powers since the blockading of Crete is even worse than before, so that Greece and Turkey really seem forced into the present war, though both have been informed that their success would mean no accession of territory to the victorious nation.

Turkey tried to throw the burden of the responsibility of the war on Greece, stating that, owing to the incursions by the Greeks on Turkish territory, their military commander was ordered to assume the offensive. This was on April 17, and since this time the Turks have been very successful in Thessaly; but the outcome of the war is still in doubt. The Turks appear to have the advantage on land and the Grecian navy on the water.

Turkey has many vulnerable points which might be attacked by the fleet of Greece, which, as we have already stated, is superior to that of Turkey. The fleet of the Greeks consists of four battleships, two first-class cruisers and twenty-five torpedo boats. Among what might be considered the vulnerable points in the Turkish dominions are Salonica, the base of supplies for the Turkish armies in Macedonia, the island of Samos, which, like Crete, is now in a state of revolt, and the Dardanelles themselves. It is thought that the Greek fleet is hardly strong enough to force the Dardanelles, but should it be successful in doing this and in defeating the Turkish fleet, which does not amount to much, it would cause great havoc among the palaces, mosques and other buildings of Constantinople. Constantinople is said to stand upon two continents, since Scutari is in Asia Minor. Vessels reach Constantinople through the Dardanelles, the narrow strait forty miles long and from one to four miles wide. The Dardanelles unite the Mediterranean with The Sea of Marmora, which is connected at its other end with the Black Sea by another narrow strait called the Bosphorus, and it is on this strait that Constantinople is situated.

The peculiar harbor, by reason of its form and fullness, is known as the "Golden Horn." Directly on the Bosphorus are palaces which are most imposing. We illustrate one of them, Dolmabaghchi, which is one of the most beautiful, but the Sultan evidently considers that it is too easy of approach and has established himself in the smaller but more secluded Yildiz palace, where he can be surrounded with his soldiers. We also give an illustration of one of the bridges which unite Galata to Stamboul, showing the animated scenes in this half-barbaric, half-civilized capital.

ALUMINUM HELMETS have not proved entirely successful in the German army, the saving in weight being more than offset by the metal's storing heat even to blistering the foreheads of the wearers.

## Andree's Balloon Voyage to the North Pole.

BY A. DANIELSON, UPSALA, SWEDEN.

On the 20th of March last, before the Society for Anthropology and Geography, in Stockholm, Sweden, Mr. S. A. Andree, the balloonist and explorer, gave a full account of the preparations for the coming polar expedition.

The plan for the ascension is the same as last year's; some slight changes, however, are made in the equipment, based on experiences during the trip to Spitzbergen last summer.

The balloon has been increased in volume 300 cubic meters. This was effected by cutting the balloon in two and inserting between the two halves a girdle one meter high. It was found necessary to increase the volume, as the balloon silk weighed close upon 300 kilogrammes more than calculated. Its weight is now 1,320 kilogrammes. The form is now somewhat elliptical.

The balloon is in good condition. The strength and tightness of the silk is unaltered. Mr. Strindberg, who has undertaken these important investigations, has found the loss of gas through the balloon cloth to be almost nil. Last year the entire balloon was found to lose through the cloth one or two cubic meters of gas during twenty-four hours.

For the tightness of the seams the overlying lists play an important part. Without them the balloon would not be able to keep floating many days. During the winter the tightening lists have been improved and altered according to the new form of the balloon. The maker, Monsieur Lachambre, has invented a new varnish especially for this balloon. By experiment it has been learned that moisture has no influence upon the tightness of the seams, and this fact has caused Mr. Andree to somewhat simplify the construction of the balloon house. The net is just as strong as ever.

There is every reason to believe that the balloon house has well withstood the Arctic winter of Spitzbergen. Mr. Andree has made himself sure that no whalers or seal hunters have passed the winter in the neighborhood. Consequently nobody has been tempted to use part of the house as fuel. In order to get an idea of the weather conditions in Virgo's Haven during the winter, Mr. Andree has communicated, through Consul Aagaard, with one of the men who, with Mr. Pike, wintered there in 1888 to 1889. This man stated that the hardest storms generally blew from the south and southwest, which perfectly agrees with Mr. Andree's theories. But from southerly winds the balloon house is sheltered by cliffs more than 100 yards in height. Thus the house is only exposed to northerly winds, but Mr. Andree, as well as the two architects who erected the structure, are of the opinion that it has suffered no essential damage. Still it goes without saying that the travelers will be provided with every means to quickly make necessary repairs.

Increased Amount of Hydrogen Gas.—For generation of hydrogen gas so much material will be brought along that the balloon can be kept filled six weeks, awaiting favorable winds, even if the loss of gas should amount to 100 cubic meters in twenty-four hours. Mr. Andree hopes to be ready to start about the 20th of June, and is thus able to wait for suitable winds up to the first days of August, and to start later in the year is not to be thought of.

To Cut the Drag Lines.—From several quarters the fear has been expressed that the drag lines might catch hold of something on the ground and arrest the balloon. Mr. Andree himself did not much believe in this danger, but now the expedition has been presented with a very ingenious device for cutting the line at any desired point. The apparatus, invented by a Mr. Torner, consists of a cylindrical metal case, which can be made to slide down the line to where it is intended to be cut. Inside of the metal case are two sharp knives driven forward with great force through the explosion of a quantity of powder. Mr. Andree exhibited a thick cable cut in this way.

When the Expedition Leaves Sweden.—The expedition leaves Lathenburg on the 18th of May. The time for the voyage to Spitzbergen and for the preparatory work there is calculated to about four or five weeks. Nothing tends to indicate that the winter at Spitzbergen has been severe, and there is every reason to believe that the expedition will find the sea free from ice.

Nansen's observations were, as far as the speaker knew, favorable for the balloon journey. This was as well regarding the temperature and the variations of the compass as the direction of the winds. Toward the end of June and in the beginning of July the Fram had in the polar basin experienced identical winds with those which Mr. Andree had noticed at Spitzbergen. Dr. Nansen has confirmed another important fact, viz., that no highlands are to be met with up to 84th or 85th degree of latitude. The explorers need not therefore fear the necessity of consuming a great amount of gas by lifting themselves over any mountain ranges.

The Desired Way.—If we are so fortunate, the speaker continued, that we may choose our way, I would rather, since Dr. Nansen has so well explored

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the polar region toward the Asiatic side, steer our balloon toward the American continent. This part of the world is not now nearly so desolate and uninhabited as it was when the Franklin expedition perished. Ever since 1889, American vessels have been stationed about the mouth of the Mackenzie River for hunting purposes, and twelve to fifteen ships pass the winter there with 400 or 500 people aboard. The speaker had got these particulars of a Swedish harpooner, Bertonocini, who has been a long time in American service there. Along the coast of Alaska are to be found more or less civilized Indians and Esquimaux. In the interior of Alaska there are a great number of gold diggers. Among the inhabitants of these vast regions information concerning the expedition is pretty widely spread, although, strangely enough, the circulars with cut of balloon have not here been distributed.

The speaker concluded with expressing his firm conviction that the outlook for the expedition is as good if not better this year than the last.

After Mr. Andree's lecture, Dr. Jaderin, the astronomer, arose and demonstrated before the society a very valuable improvement on the usual sextant, enabling the observer to make careful determinations even if he is oscillating and above the ground as when he is sitting in the car of a balloon. Dr. Jaderin calls his instrument "nivasextant" (the level sextant), and experiments have shown the error to amount to only about 2′.

Dr. Nils Ekholm will not accompany Mr. Andree. He has backed out, as he does not consider the undertaking likely to succeed. The party will now consist of Mr. Andree, chief engineer (ofveringenior) at the Royal Swedish Patent Office, Mr. Strindberg, amanuensis at the University of Stockholm, and lastly Mr. Fraenckel, civil engineer.

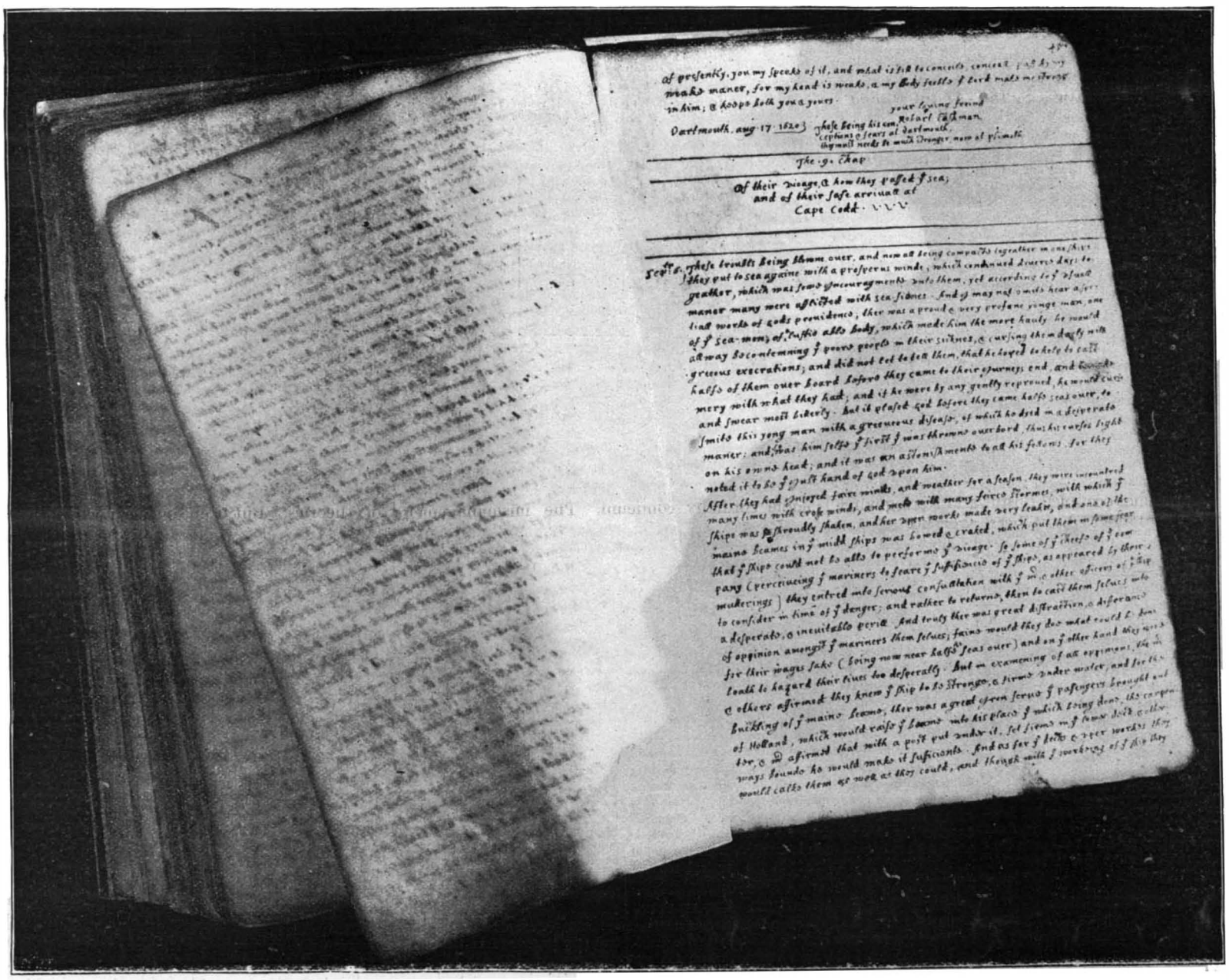
## THE LOG OF THE MAYFLOWER.

A graceful act of international courtesy on the part of the Consistory Court of London has drawn attention to the remarkable history of a manuscript volume which is essentially one of the most precious heirlooms of the American nation, although it has long been stored in English keeping. The Pilgrim Fathers who left their native land on board the Mayflower in 1620 bequeathed to their children a detailed chronicle of all their doings in the form of a manuscript book, entitled "The Log of the Mayflower." This volume, destined to acquire a unique importance as an historical document, was compiled by William Bradford, one of the foremost members of that devoted band which set forth into the unknown for conscience' sake, and subsequently governor of Plymouth Colony, and within its pages were recorded the names of all the pilgrims and the chief incidents of their voyage and ultimate landing at Cape Cod. But the log of the Mayflower did not end with the voyage. Its narrative was continued as a history of the formation of the first settlement at New Plymouth, and of the general colonization work of the next twenty-eight years. The inclusion of an official register of baptisms, marriages and funerals added a legal importance to the historical value of this authoritative account of the origin of New England. It was probably due to this circumstance that the volume was some time or another sent to the library of Fulham Palace, for up to the time of the Declaration of Independence the American colonies, strangely enough, formed part of the diocese of London. Nothing is definitely known, however, of the transference of this valuable document from the new country to the old beyond the fact that it has been stored at Fulham Palace with other archives of the diocese of London. But at last the historic log is to be restored to the commonwealth of whose earliest beginnings it forms so precious a relic. At the application of the United States ambassador, the Consistory Court of London has decided, with the approval of the bishop, to hand over the volume to the President of the United States, zincographic copies being kept for the diocesan registry and the episcopal library at Fulham Palace.

This decision naturally recalls the tender solicitude with which everything associated with the sailing of the Pilgrim Fathers is regarded by all true Americans. Anti-British politicians may do their utmost to prevent the tightening of the bonds of friendship which should unite the two great English-speaking peoples, but there will still remain a huge section of new world inhabitants actuated by feelings of keenest admiration and deepest sympathy for the old mother country. The State of Massachusetts is especially interested in the present act of courtesy. It was a vicar of Boston in Lincolnshire who practically founded the chief city of Massachusetts. Several of the earliest governors of Massachusetts hailed from the Lincolnshire Boston. Governor Bellingham, whose character is sketched in "The Scarlet Letter," was recorder of the old England town. William Brewster, chief of the Pilgrim Fathers, and William Bradford, who kept the log of the Mayflower, both suffered imprisonment at Boston before they managed to find a way of escape for their Puritan brethren. And, seeing that the new Boston claims to be "the hub of the universe," optimists may detect great significance in the generous surrender of what, to Bostonians even more than to Great Britain, is a precious historical record and antiquarian treasure.

The little village of Scrooby, on the borders of Lincolnshire and Nottinghamshire, where Brewster lived and taught lessons in freedom to Bradford and other brave souls, has been denominated "the cradle of Massachusetts." And if so, why not "the cradle of the American nation"?

The traveler on the Great Northern Railway from London may catch a glimpse of the slim white spire of Scrooby church on his left ere he reaches Doncaster. Visitors from Massachusetts know it well. There are two shrines that the enthusiastic American tourist never misses. One is Stratford-on-Avon; the other, Brewster's old manor house at Scrooby, with the neighboring village of Austerfield, where William Bradford first saw the light. There is, indeed, comparatively little left of the structure that was familiar to the secret worshipers of Brewster's day. One of the few old oak beams remaining has already been secured by an enterprising descendant of the Pilgrim Fathers to adorn his dwelling across the seas, and, bit by bit, other memorials of the past are finding their way over the Atlantic to keep alive the feeling of kinship between New England and the old. The Norman font at which William Bradford was baptized still occupies a place in Austerfield church, and the parish register contains Bradford's baptismal entry. This quaint old edifice sadly needs restoration; and Americans, in particular, are being invited to contribute to the fund. So far, their response is not encouraging, nevertheless the church wardens intend to retain the font. As the Earl of Crewe writes in his appeal on behalf of the memorial fund, Austerfield is linked with Scrooby, the home of Brewster, as a cradle of the Pilgrim Fathers; and so long as the sailing of the Mayflower remains one of the historic cameos upon which English and American eyes alike love to rest, the footsteps of travelers will turn toward these quiet little hamlets in reverence for the men who embarked on an even nobler quest than did the fleet of Columbus.—Illustrated London News.




THE LOG OF THE MAYFLOWER—FACSIMILE OF THE BOOK.

ICHTHYOL is recommended by Der Stein der Weisen as a much better remedy for insect bites than ammonia

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## RECENTLY PATENTED INVENTIONS.

### Engineering.

REVOLVING MUFFLE FURNACE.—August R. Meyer, Kansas City, Mo. To facilitate the desulphurizing or chloridizing of ores or metallurgical products, this furnace has formed in its walls a revoluble cylinder with independent longitudinal flues, the furnace discharging successively into the flues, and there being a channel at the end of the cylinder, but remote from the furnace, connecting the cylinder flues, and adapted to be placed in communication with the interior of the cylinder. An outlet at the furnace end of the cylinder is also adapted to be successively connected with the cylinder flues. The products of combustion travel twice through the flues before passing off to the chimney, utilizing the dust to the fullest advantage, and the products of combustion are kept entirely separate from the material under treatment.

FEED WATER HEATING APPARATUS.—Elihn K. Jones and Thomas N. Wilson, Fulton, Oregon. According to this improvement the feed water is forced through hollow grate bars on its way to the boiler, the main grate bar having a series of parallel lengthwise passages, and there being joined to it a series of minor grate bars having like communicating passages, while a series of pipes connect the main grate bar with the upper portion of the boiler, and a pipe connects the lower portion of the boiler with the grate. A practically equal distribution and circulation of water in all portions of the grate are assured, and normally all the water from the pump passes through the grate before entering the boiler.

### Railway Appliances.

FARE BOX.—Oscar Katzenberger, San Antonio, Texas. This invention provides a receptacle for fares especially adapted for use on cars or other vehicles, the fare to be paid by each occupant upon entering, and the construction permitting the driver, motorman, or gripman to readily ascertain the amount of fares paid. Each fare is registered as paid in, and the receptacle may be opened by the driver or conductor to make change. The person depositing the fare may also know immediately that it has been registered, and coins paid in excess of or in denominations less than the coin of the fare are delivered to a receptacle not accessible to the conductor or driver.

### Electrical.

UTILIZING ROENTGEN RAYS.—Charles F. Easton, Wallace, Idaho. An improved lantern for employing the Roentgen rays for experimental, demonstrative or practical purposes, has been devised by this inventor, the lantern body being opaque to X rays, and having a front aperture and fixed disk whose central opening registers therewith, while an adjacent parallel rotatable disk has graduated apertures which may be brought into coincidence with those in the fixed parts. Arranged in the case on a sliding carriage is a Crookes tube, and means for making a rapid or slow and fine adjustment of the tube.

TELEGRAPH KEY.—Martin M. Porter, Malone, N. Y. This invention provides a simple and positive means for automatically closing the circuit through the instrument after the key shall have been released by an operator. The improvement comprises a spring plate adapted for electrical connection with a line wire, a key lever, and a finger piece of insulating material, to which is attached a metal contact having electrical connection with the key lever, while a plate hinged to swing vertically on the finger piece has a projection adapted to engage with the spring plate to force it out of engagement with the contact on the finger piece.

ELECTRIC SELLING DEVICE.—Alexander Davidson, New York City, and Charles G. Armstrong, Chicago, Ill. To sell reserved seat tickets at different stations, and prevent the sale of the same ticket at two different stations, according to this invention, the stations are connected electrically and each has duplicate electrical apparatus, whereby a sale at one station is automatically reported at the other stations. If the same ticket be offered for sale at two different points, the device is rendered inoperative and a visual or audible sound is given. The invention comprises synchronous clocks connected in circuit with a master clock, each clock being combined with a commutator, battery, signal bell, and annunciator board, etc., there being also a three-wire circuit for the operative parts of the ticket selling devices.

### Mining, Etc.

SILVER AND GOLD ORE PROCESS.—Henry Hirsching, Salt Lake City, Utah. This process relates principally to the obtaining of copper from copper ores, but is also applicable for obtaining the silver and gold, whether with or without copper. It is an ammonia process, especially advantageous and economical with refractory ores, whether with or without copper, and where melting or other processes would not be satisfactory or profitable, and consists in subjecting them to the action of a solvent to dissolve the metals and then electrolyzing the solution, first with a cathode of the precious metal and then with a copper cathode.

### Mechanical.

METALLIC PACKING.—Edward L. Raynsford, Susquehanna, Pa. This invention is for an improvement on formerly patented inventions of the same inventor, and provides a packing for use on piston and valve rods, piston slide valves, and other machine parts, the packing being arranged to prevent all leakage, and readily compensate for wear of the parts, insuring a perfect joint at all times. It is made with a sectional ring having overlapping joints, and on its periphery is a transverse recess extending over the overlapping joint, a segmental block fitting in the recess to cover the joint.

LIFTING JACK.—William W Goodwin and George A. Brown, Carthage, Me. This is a jack of the screw type which may be operated in small space and with but little friction, being capable of elongation in both directions from the center to a length equaling twice its length when closed. The screw rod of the jack has right and left threads starting from its center, each thread engaging an interiorly threaded cap, and the ends of the caps having teeth to interlock with wood or other material with which the jack may be operated, these caps also engaging the auxiliary screw threaded caps or extension pieces, to provide for a greater range of adjustment of the jack.

### Agricultural.

LISTER CULTIVATOR.—Cornealious P. Welter, Perry, Kansas. The cultivator blades or disks of this simple and inexpensive machine are at opposite sides of the runners, and may be simultaneously raised or lowered, there being means for adjusting the blades or disks toward and from the draught line of the carrier, in proper position for rows of different widths. The parallel sleigh shaped runners are connected by arched bars, and a rock shaft journaled on the runners has arched center and angular ends on which the cultivator blade carriers are mounted, and the shaft is rocked to raise and lower the cultivator blades by means of a hand lever within easy reach of the driver.

CUTTING ROOTS, ETC.—John J. Sherman, Traverse City, Mich. The body of this machine comprises a box slotted in opposite sides, a cutter in the front slot and a handle lever projecting through the rear slot, the lever having a broad portion adapted to serve as a false oscillatory bottom to support the tubers or roots placed in the box to be cut. The knife may be readily removed for sharpening, and is adjustable for varying the thickness of the pieces or slices cut; it also has attached short supplemental knives to further divide the material into pieces or slices.

### Miscellaneous.

CENTRIFUGAL MACHINE.—Peter Cooper Hewitt, New York City. Two patents have been granted this inventor for an improved machine for separating liquids from viscid or solid substances by centrifugal force, the construction being designed to obtain the best effects with a minimum expenditure of power, and effect the complete separation of substances where partial success only has heretofore been obtained. The invention comprises a separating bowl of small diameter and comparatively great length, with weirs for controlling the distribution of the liquid or mixture to be operated on, there being a peripheral discharge controlled by a valve and valve operating mechanism. Combined with the bowl are perforated hoops and perforated annular plates within the bowl to check the free circulation of the material acted on, and weirs of novel construction discharge the light and heavy liquids automatically into hoods. The bowl has improved bearings at its upper and lower ends, to facilitate the maintenance of a high velocity, there being a lubricating device for the lower bearing and an adjusting device for the upper one. The later improvement more especially adapts the machine for the separation of liquids and such solids and semisolids as are discharged from the separating bowl with difficulty, and for the separation of living organisms which have a different density from the liquid they grow in, but have the power to remain suspended in the liquid.

APPARATUS FOR AERATING LIQUIDS.—This is a further invention of the same inventor, especially applicable in aerating waters, beer and other liquids. It consists of a centrifugal machine constructed particularly to reduce the liquid to the form of an extremely thin film, the machine being operated in a covered vessel suitable for the required pressure, and the beer or other liquids being aerated while in the form of a highly attenuated film. When it is necessary to carry on the operation under a pressure greater than that at which the liquid is to remain, the liquid is carried to a storage reservoir through a pressure reducer which allows the gas to expand in the reservoir, whence it is taken back to be used again in aeration, while the liquid is held in the storage reservoir at the required reduced pressure.

BEER MANUFACTURING APPARATUS.—Still another patent of the same inventor provides an improved apparatus for brewing, in which the fermenting vat is connected with a gas receiver, where the gas developed may be stored under pressure, and a cooling chamber, from which the beer is conveyed to a separator or purifier and aerator, the latter being connected with the gas receiver to utilize the gas generated during fermentation. A valve controlled pipe connects the beer receiving tank with the aerator, and a connected storage tank is also connected with the aerator and the gas receiver.

PROTECTING REGISTRY ROLLS.—Charles A. Schindler, Jr., West Hoboken, N. J. To arrange rolls exhibiting the names of voters that they may be readily examined, and posted where desired without being damaged by the weather, this invention provides a protecting casing having an opening in its bottom edge, an upper spring-actuated roller to which a flexible carrier is attached, there being stops at the top and bottom of the case and a combined guide and stop on the carrier, with means for clamping the registry rolls to the carrier. By removing the cap of the case, the roller, with its carrier, and the registry rolls are all easily removed.

BICYCLE SUPPORT.—Francis P. McNulty and Thomas McDermott, Cincinnati, Ohio. This support is adapted to swing from the rear wheel spindle, which is extended at each side and engages two-part nuts, the latter engaging the ring or top portion of the support, which is formed of a rod bent to constitute a foot at its outer end. In supporting a wheel these rods extend slightly out at each side, the feet engaging the ground, but when not so required as supports the rods are turned up to engage the rear fork. One of these rodlike supports only may be used, instead of two, as one prefers.

BICYCLE TRACK.—John B. Hansler. Newburg, N. Y. To furnish a cheap and smooth track for wheelmen between towns and villages, and one which may be readily constructed in a more direct course than the ordinary highways, is the object of this invention, according to which the track is formed of metal plates having their edges rolled upward and inward and then outward, dovetail locking devices fastening the ends of the plates to each other and to supporting cross beams, the latter being held up by vertical posts which extend into the ground through plates which act as sills. The posts are adjustable to support the cross timbers and track at the desired level, and drainage holes are provided in the track plates.

BREAKDOWN FIREARM.—Charles E. Whilden, Charleston, S. C. For three barrel guns having two shot barrels and a rifle below and between them, this inventor provides an improved arm with a removable rifle barrel, to be so placed in connection with the shot barrels that it can be attached firmly to a suitable support, and quickly removed when it is desired to lighten the gun, the removable barrel permitting the employment of many different calibers of rifle barrel with the same stock. A cocking and firing mechanism for the rifle hammer is located within the body of the gun, and the trigger is of novel construction, only two triggers being required for the three barrels.

TYPEWRITING MACHINE.—Andrew J. Speare, West Plains, Mo. This invention is for an improvement in typewriters which, after a line of writing is completed, return the carriage and cylinder automatically instead of by hand, and provides an improved construction and arrangement of parts for feeding the carriage positively and directly by the action of the keys, for automatically returning the carriage after a line of writing is completed or in the middle of a line, and for automatically turning the cylinder to present a new space for a line of writing.

CASH INDICATOR AND REGISTER.—John F. Parker, McPherson, Kansas. This is a machine of comparatively simple mechanism for registering all individual sales and cash receipts from one cent upward, and indicating the total amount of sales and receipts. By pressing down a finger piece at one side of the casing, the registration of the previous sale is canceled and the cash drawer opened, to be closed by hand after the next registration is made, but, to guard against compounding the registrations, only fifteen seconds is allowed for the drawer to remain open, automatically working mechanism then locking the parts. This time may be varied according as the owner desires in setting the machine.

A NEW COLORING AGENT.—Georg H. Weiss, Charlottenburg, Germany. To form black chrome mordanted wool dyestuffs exceedingly fast to light, milling and soap, this inventor has devised a process of making carbonyl metadiamido salicylic acid, which consists in treating nitroamido salicylic acid with phosgene, thereby producing carbonyl metanitroamido salicylic acid having a melting point of approximately 283° C., and finally reducing the product to carbonyl metadiamido salicylic acid, soluble with difficulty in water and alcohol, insoluble in benzine, ligroine and chloroform, easily diazotizable, the diazo compound forming, by combination with the usual color producing substances, azo dyestuffs which are easily mordanted.

DIE HOLDER AND BOX.—Robert Turner, New York City. To hold dies for stamping and embossing, this box is open at one end, and has a removable end piece held by catches, there being die clamping devices in the end piece and in the opposite side of the box, while a false side and its opposite side have guideways for the dies, held in place by a clamping device. The box is arranged to hold separate dies forming matter to be stamped or embossed, the dies being interchangeable to permit of setting up any desired matter.

PAPER HOLDER.—Thomas P. Mautz, Stewardson, Ill. Two patents have been granted this inventor for a superior receptacle for paper in sheets of different lengths or paper bags, the device holding the material in graduated arrangement, enabling a person to readily select and withdraw a sheet or bag of the desired dimensions. The holder has a box or body portion with removable partitions, having pockets at their lower ends, and each partition being independent, although each serves to brace and strengthen the casing or holder. The holder is used in an upright position for heavy paper and in inclined position for light or manila paper. Although principally intended to hold wrapping paper, it can be used to hold any kind of sheet paper, its simplicity and cheapness making it practical for everyday use.

PREPARING NUTMEAL.—John H. Kellogg, Battle Creek, Mich. To produce an improved article from peanuts or other nuts, this inventor blanches the kernels and removes their cuticles, then boils them for several hours until they are thoroughly cooked and soft, dries the cooked product, and subjects it to a heavy pressure between rollers. Two products are thus obtained, a dry and practically white nutmeal and a pasty substance described as nut butter.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

## NEW BOOKS, ETC.

THE UNIVERSITY TUTORIAL SERIES. THE TUTORIAL CHEMISTRY. Part I. Non-metals. By G. H. Bailey. Edited by William Briggs. London: W. B. Clive, University Correspondence College Press. New York: Hinds & Noble. Pp. viii, 226. Price $1.

THE UNIVERSITY TUTORIAL SERIES. THE TUTORIAL STATICS. By William Briggs and G. H. Bryan. London: W. B. Clive. New York: Hinds & Noble. Pp. viii, 260. Price $1.

These two works are designed to cover chemistry and statics as required for passing the London University examination for a degree. Like all such books, while useful, they are of limited and accurately defined scope, which scope is fixed by the requirements of the English course. This renders them of restricted value for the American student.

CLAY GLAZES AND ENAMELS. With a supplement on crazing, its causes and prevention. By Henry R. Griffin, C.E. The whole forming a treatise on glazing and enameling brick, terra cotta, and pottery. Including exact recipes and formulas for all the principal colors now in use and full instructions for their preparation and application. Indianapolis, Ind.: T. A. Randall & Company. Pp. 138. Price $5.

Of all practical subjects, the subject of the present work has been one the details of which are most difficult to obtain. A glaze which would not crack and which would work with unfailing certainty time after time has been a desideratum for a long time. The present work on the subject very thoroughly tells not only how to make glazing, but gives the technique of the blending, etc. It is not too much to say that it will fill a long felt want, as it fills in the field of what has long been a trade secret.

TURKEYS AND HOW TO GROW THEM. A treatise on the natural history and origin of the name of turkeys, the various breeds, and best methods to insure success in the business of turkey growing. With essays from practical turkey growers in different parts of the United States and Canada. Edited by Herbert Myrick. Copiously illustrated. New York: Orange Judd Company. 1897. Pp. vii, 154. Price $1.

This monograph treats of a subject of great interest to farmers. No gallinaceous bird perhaps is more troublesome in managing than the turkey, and certainly none can be said to give more satisfactory results. This monograph should lead to increased success in the cultivation of the noblest of the tribe, and in the present days of poultry raising, the use of the incubators and other refined supplements lead to more than the ordinary expense.

HYPNOTISM UP TO DATE. By Sydney Flower. Chicago: Charles H. Kerr & Company, 56 Fifth Avenue. 1896. Pp. 161. Price $7.

The author of this curious book seems to be a believer in some of the extreme views of hypnotism and at the same time states his views in a very guarded way, so as to give one the idea that he is very conservative. The book is written in the form of dialogues between a physician who is a hypnotist and his patient. The author ingeniously enough shows some skill in avoiding troublesome explanations. Thus, at the end of the first chapter, he states that the doctor explained the feats of mind readers, and, instead of giving them, states that the explanations were so simple and so convincing that the author prefers not to publish them, not wishing to make public the evidence of his own gullibility. Had he given a real, thorough treatment of the subject, instead of thus avoiding it, and had he devoted some space to the natural magic of the mind reader as well as to the hypnotist, he would have performed, we think, a very acceptable service. The psychologist of the day is vibrating between full fledged hypnotism on one hand and materialism on the other, and this book may be a contribution to the lighter literature of the subject. Some of the author's criticisms on Conan Doyle and others are very amusing.

DIE BEARBEITUNG DES GLASES AUF DEM BLASETISCHE. Ein Handbuch für Studirende, welche sich mit Wissenschaftlichen Versuchen beschäftigen. Von D. Djakonow und W. Lermantoff. Mit 30 Abbildungen. Berlin: Verlag von R. Friedländer & Sohn. 1895. Pp. xiii, 154.

This nicely illustrated book with contents, but, unfortunately, without index, is devoted to glass blowing for the chemist and physicist, including the manufacture of strictly scientific apparatus by glass blowing before a blast lamp. The author follows the German custom of using a single blast lamp, instead of the converging jets of flame so generally used by the professional glass blower. The book is very systematically arranged, well illustrated, and its divisions indicate really thorough covering of the ground. It seems as if the work might repay translation, except that America is hardly yet ready for this class of monograph.

THE MANUAL OF STATISTICS AND STOCK EXCHANGE HAND BOOK. New York: Charles H. Nicoll. 1897. Pp. 500. Price $5.

The nineteenth annual issue of this work maintains the reputation of its predecessors, which has made the publication a standard reference authority for investors, bankers and brokers, and all interested in the values and fluctuations in prices of properties whose securities are dealt in by the public. The book covers especially all railroads and street railways, miscellaneous corporations, coal companies, cotton and petroleum, banks and trust companies, insurance companies, the mineral industries, etc.

METALS: THEIR PROPERTIES AND TREATMENT. By A. K. Huntington and W. G. McMillan. London and New York: Longmans, Green & Company. 1897. Pp. 562. Price $2.50.

In the series of text books of science adapted for the use of artisans and students in public and science schools, published by this well known firm, this volume occupies a most important place, especially the new edition, edited and brought up to date by a professor of metallurgy in King's College, London, and a lecturer on the same subject in Mason College, Birmingham. The latest forms of furnaces, some of which are hardly yet considered as beyond the experimental period, are here illustrated and described. The work deals but sparingly in chemical and mathematical formulæ, and every chapter in the book is well within the comprehension of any intelligent mechanic or ambitious young apprentice.

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## Business and Personal.

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Colorado's Gold Fields, Illustrated.

Just out, with correct map and nearly 100 mining views natural as life. This valuable book will be sent free prepaid with our big 56 col. family paper 3 months on trial for 25c.; club of 5 and 5 books $1. Latest mining news. Mention the S. AM. and address Illustrated Weekly Sentinel, Denver, Colo. Cripple Creek is fully described.

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### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7158) J. W. W. asks (1) for a rule for setting over a lathe tail stock, for turning tapers. A. Set over the tail stock equal to half the difference in the diameter of the cone for the whole length between the centers. 2. Do lenses ever lose their magnifying power or become non-achromatic? A. Lenses do not lose their magnifying power nor become non-achromatic. 3. Is there any benefit derived from sleeping with the head toward the north? A. A magnetic soothing effect is claimed for the meridional position of the body in sleep. Perhaps imagination has much to do with it. 4. Is there a process for making green prints like the fero-prussiate or blue print, except the difference in color? A. Green prints are made by using a green pigment in the carbon process.

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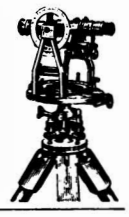

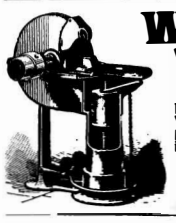

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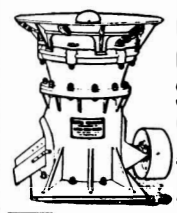

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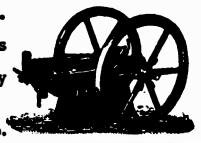

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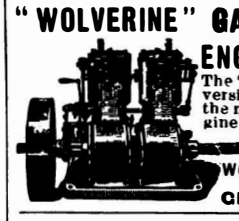

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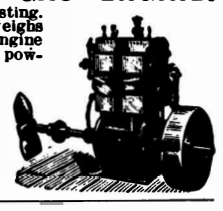

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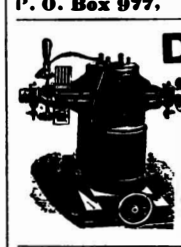

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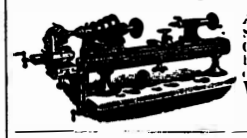

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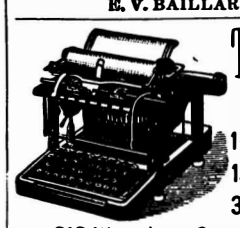

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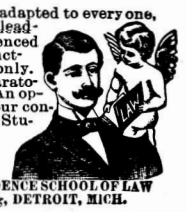

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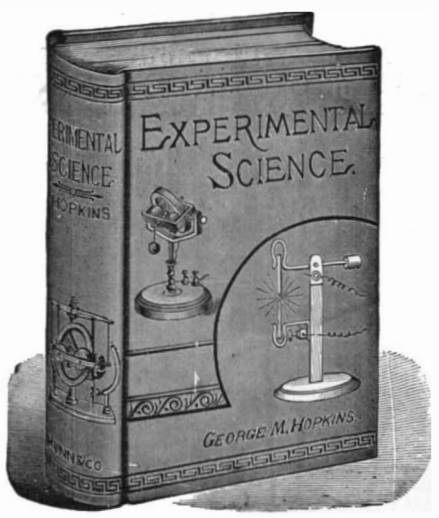


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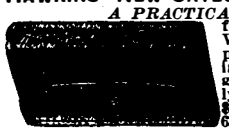

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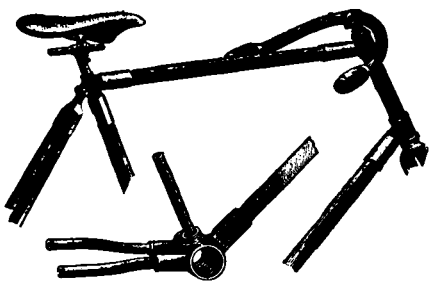

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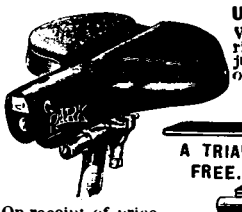

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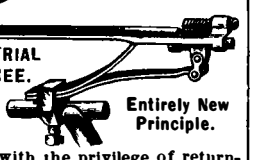


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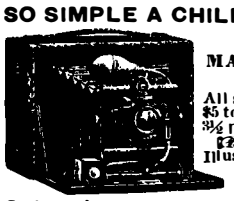

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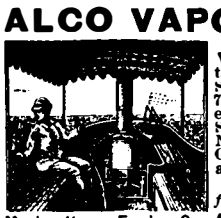

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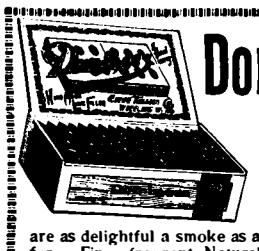

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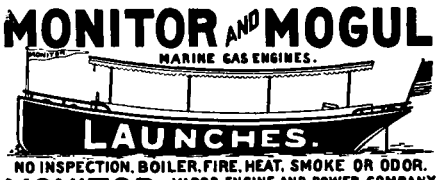


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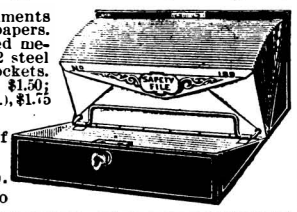

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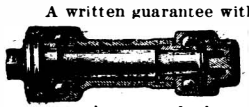

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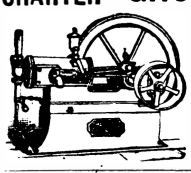

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You'll feel better—look better—work better—ride a Columbia—you'll be proud of your wheel, its the best.

**Columbia Bicycles**
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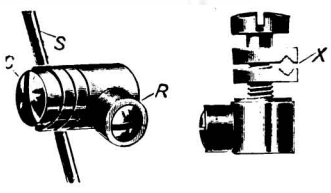


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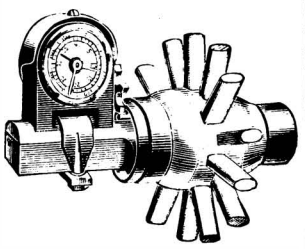

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It will tell you honestly how many miles you drive, and announce each mile by stroke of a bell. Keeps a record for 1000 miles and then repeats. **Speed horses** may be timed very accurately. Fully warranted. Price, by mail, $5.00. In ordering send height of rear wheel.
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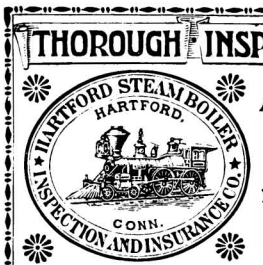


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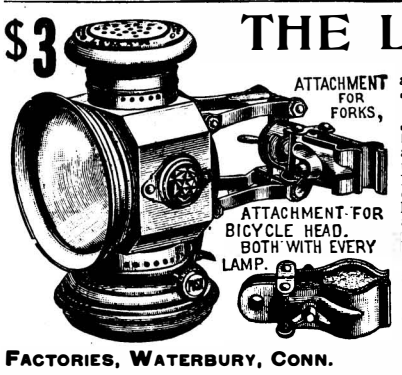


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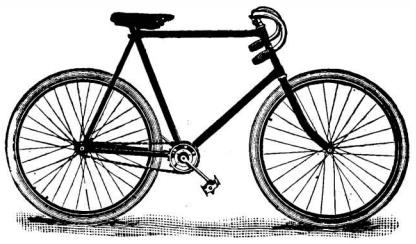

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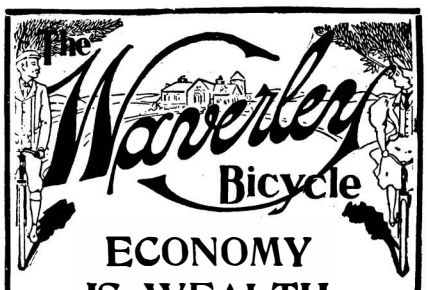


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**$60**

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